# FINAL

## REMEDIAL ACTION PLAN FOR GROUNDWATER
## FORMER EATON CORPORATION FACILITY
## 1100 EAST PRESTON STREET
## SELMA, JOHNSTON COUNTY, NORTH CAROLINA
## LONGITUDE W78°17'02", LATITUDE N35°31'33"
## NONCD 0002853

Prepared for:
**Eaton Corporation, Inc.**
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Prepared by:
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**Solutions-IES Project No. 2013.0014.EATN**

**June 3, 2013**

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REC PROGRAM DOCUMENT CERTIFICATION FORM - PAGE 1 OF 2
IHSB SITE NAME NONCD 0002853 / Former Eaton Selma Facility
DATE & NAME OF DOCUMENT 6/5/2013 Remedial Action Plan
TYPE OF SUBMITTAL (circle all that apply): Report, Work plan, Work Phase Comp. Statement, Schedule Change

## REMEDIATING PARTY DOCUMENT CERTIFICATION STATEMENT (.0306(B)(2))

"I certify under penalty of law that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this certification, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material and information contained herein is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for willfully submitting false, inaccurate or incomplete information."

KAREN E. SOUZA – AGENT FOR EATON
Name of Remediating Party

Karen E. Souza
Signature of Remediating Party

6-4-13
Date

**NOTARIZATION**

Pennsylvania (Enter State)

Allegheny COUNTY

I, Barry L. Risch, a Notary Public of said County and State, do hereby certify that Karen E Souza did personally appear and sign before me this day, produced proper identification in the form of Pennsylvania Drivers License, was duly sworn or affirmed, and declared that, to the best of his or her knowledge and belief, after thorough investigation, the information contained in the above certification is true and accurate, and he or she then signed this Certification in my presence.

WITNESS my hand and official seal this 4th day of June, 2013.

Barry L. Risch
Notary Public (signature)

(OFFICIAL SEAL)

My commission expires: December 17, 2015

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Barry L. Risch, Notary Public
Buffalo Twp., Butler County
My Commission Expires Dec. 17, 2015
MEMBER, PENNSYLVANIA ASSOCIATION OF NOTARIES

*Document Certification Form No. DC - 1*
*(Revised 8/11)*

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IHSB SITE NAME NONCD 0002853 / Former Eaton Selma
DATE & NAME OF DOCUMENT 6/5/2013 Remedial Action Plan
TYPE OF SUBMITTAL (circle all that apply): Report, Work plan, Work Phase Comp. Statement, Schedule Change

## REGISTERED SITE MANAGER CERTIFICATION OF SIGNATURES

As the Registered Environmental Consultant for the Site for which this filing is made, I certify that the signatures included herewith are genuine and authentic original handwritten signatures and/or true, accurate, and complete copies of the genuine and authentic original handwritten signatures of the persons who purport to sign for this filing. I further certify that I have collected through reliable means the originals and/or copies of said signatures from the persons authorized to sign for this filing who, in fact, signed the originals thereof. Those persons and I understand and agree that any copies of signatures have the same legally binding effect as original handwritten signatures, and I certify that any person for whom I am submitting a copy of their signature has provided me with their express consent to submit said copy. Additionally, I certify that I am authorized to attest to the genuineness and authenticity of the signatures, both originals and any copies, being submitted herewith and that by signing below, I do in fact attest to the genuineness and authenticity of all the signatures, both originals and copies, being submitted for this filing.

M. Tony Lieberman
Name of Registered Site Manager

M. Tony Lieberman
Signature of Registered Site Manager

6/5/13
Date

## REGISTERED SITE MANAGER DOCUMENT CERTIFICATION STATEMENT (.0306(b)(1))

"I certify under penalty of law that I am personally familiar with the information contained in this submittal, including any and all supporting documents accompanying this certification, and that the material and information contained herein is, to the best of my knowledge and belief, true, accurate and complete and complies with the Inactive Hazardous Sites Response Act G.S. 130A-310, et seq, and the remedial action program Rules 15A NCAC 13C .0300. I am aware that there are significant penalties for willfully submitting false, inaccurate or incomplete information."

M. Tony Lieberman
Name of Registered Site Manager

M. Tony Lieberman
Signature of Registered Site Manager

6/5/13
Date

### NOTARIZATION

North Carolina (Enter State)

Wake COUNTY

I, Debra A. Tabron, a Notary Public of said County and State, do hereby certify that M. Tony Lieberman did personally appear and sign before me this day, produced proper identification in the form of Driver's License, was duly sworn or affirmed, and declared that, he or she is the duly authorized environmental consultant of the remediating party of the property referenced above and that, to the best of his or her knowledge and belief, after thorough investigation, the information contained in the above certifications is true and accurate, and he or she then signed these Certifications in my presence.

WITNESS my hand and official seal this 5th day of June, 2013.

Debra A Tabron
Notary Public (signature)

(OFFICIAL SEAL)

DEBRA A. TABRON
Notary Public
Wake County
NORTH CAROLINA

My commission expires: 8.22.15

*Document Certification Form No. DC - II*
*(Revised 8/11)*

# PROPOSED REMEDIAL ACTION PLAN COMPLETION CERTIFICATION
## 15A NCAC 13C.0306(b)(5)(C)

Media (check all that apply): ☐ All Media ☐ Soil ☑ Ground water ☐ Surface water ☐ Sediment

Site Name: Former Eaton Corporation Facility

County: Johnston

Site ID No.: NONCD 0002853

Street Address: 1100 East Preston Street
Selma, North Carolina 27576

**The proposed remedial action plan, which is the subject of this certification has, to the best of my knowledge, been completed in compliance with the Inactive Hazardous Sites Response Act G.S. 130A-310, et seq. and the remedial action program Rules 15A NCAC 13C .0300, and** Solutions-IES, Inc. [REC Name] **is in compliance with Rules .0305(b)(2) and .0305(b)(3), of this section. I am aware that there are significant penalties for willfully submitting false, inaccurate or incomplete information.**

M. Tony Lieberman
RSM Signature

6/5/13
Date

M. Tony Lieberman
RSM Name

Solutions-IES, Inc.
REC Name

#00090
REC No.

1101 Nowell Rd.
Mailing Address

Raleigh, NC 27607
City, State, ZIP

**NOTARIZATION**

North Carolina (Enter State)

Wake **COUNTY**

I, Debra A. Tabron, a Notary Public of said County and State, do hereby certify that M. Tony Lieberman did personally appear and sign before me this day, produced proper identification in the form of Driver's License, was duly sworn or affirmed, and declared that, he or she is the duly authorized environmental consultant of the remediating party of the property referenced above and that, to the best of his or her knowledge and belief, after thorough investigation, the information contained in the above certification is true and accurate, and he or she then signed this Certification in my presence.

WITNESS my hand and official seal this 5th day of June, 2013.

Debra A. Tabron
Notary Public (signature)

(OFFICIAL SEAL)

DEBRA A. TABRON
Notary Public
Wake County
NORTH CAROLINA

My commission expires: 6.22.15

*Work Phase Completion Form No. WPC – III*
*(Revised 3/11)*

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# 1.0 INTRODUCTION

This Remedial Action Plan (RAP) for Groundwater has been prepared for the Eaton Corporation (Eaton) former facility located at 1100 East Preston Street in Selma, Johnston County, North Carolina. The Former Eaton Facility is located about 0.5 miles northeast of the intersection of US Highway 95 and NC Highway 70. The site location map is provided as **Figure 1**. The former Eaton Selma facility consists of approximately 20 acres of developed and wooded land with a 90,000 square foot manufacturing building and three smaller storage buildings. These smaller storage buildings are located north of the manufacturing building. A site map is provided in **Figure 2**.

In October 2008, Eaton applied to enter the Registered Environmental Consultant (REC) Program as administered by the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Waste Management (DWM), Inactive Hazardous Sites Branch (IHSB), Superfund Section. The final Administrative Agreement was executed by NCDENR on February 10, 2009. Solutions-IES, Inc. (Solutions-IES) is the designated REC for this project on behalf of Eaton, the Responsible Party (RP), and Mr. M. Tony Lieberman of Solutions-IES has been assigned to work on behalf of the IHSB as the Registered Site Manager (RSM).

The Phase II Remedial Investigation (RI) Report for the site, dated February 8, 2012, was prepared by Solutions-IES and submitted to NCDENR. In order to meet the REC deadlines of implementing the groundwater remedy within two years of certification of the RI Report, Eaton has elected to prepare this RAP for groundwater and will address soil separately. The conclusions from the Phase II RI Report are summarized as follows:

- Tetrachloroethene (PCE) is the primary contaminant of concern (COC) in soil;
- PCE, trichloroethene (TCE), and 1,1-dichloroethene (1,1-DCE) are the primary COCs in groundwater;
- Other volatile organic compounds (VOCs) have been detected in soil and groundwater in excess of either the ISHB preliminary soil remediation goals (PSRGs) in soil or the 15A NCAC 2L .0202 groundwater standards (NC 2L Standards) in groundwater;
- VOCs in the surface water sample collected in Bawdy Swamp Creek do not exceed the 15A NCAC 2B Surface Water and Wetland Standards (NC 2B Standards);
- Sediment in Bawdy Swamp Creek has not been impacted;
- The horizontal and vertical extent of soil and groundwater impacts has been delineated.

This RAP has been prepared in accordance with the REC program format. It evaluates and screens several groundwater remediation technologies that are potentially applicable to this site. From that

screening process, four potential groundwater remedial actions are developed, and further evaluated according to the criteria described in Section 15A NCAC 13C .0306(l)3(A) through (H) of the REC Program Implementation Guidance (November 2012, Edited December 2012). A preferred remedy is selected and described in greater detail, along with the criteria for remedial action completion, identification of health and safety issues, and a performance monitoring plan.

# 2.0 SUMMARY OF REMEDIAL INVESTIGATION RESULTS

This section summarizes the results of the RIs that have been completed at the site, and presents the site conceptual groundwater model.

## 2.1 GEOLOGY

### 2.1.1 Local and Regional Geology

The site is located at the boundary between the Coastal Plain and Piedmont Physiographic Provinces where Coastal Plain sediments feather onto residual soil weathered from metamorphic and igneous bedrock. The 1985 Geologic Map of North Carolina (Rhodes and Conrad, 1985) shows the site area to be underlain by recent-aged terrace deposits and upland sediments that are described as gravel, clayey sand, and sand with minor occurrences of iron-cemented sandstone. Marine sediments of the Yorktown Formation have been mapped approximately 2 miles southeast as isolated outcrops southwest of the site. Older Cretaceous-aged sediments of the Cape Fear and Middendorf Formations are mapped several miles southwest and east of the site. Crystalline bedrock, mapped as biotite gneiss and felsic metavolcanics, is present a few miles west of the site. The Coastal Plain sediments thicken considerably within a short distance to the east. The location of a geologic cross-section designated A – A' is shown in **Figure 2** and the cross-section is presented in **Figure 3.**

The soils present at the site are typically poorly drained soils on broad smooth flats and in shallow depressions in the uplands on the Coastal Plain. Surface soils in undisturbed areas at the site tend to consist of a few inches of topsoil underlain by residual sedimentary deposits of sand and gravel, and then clayey silts. The site soils have been mapped as Rains, Goldsboro and Lynchburg sandy loams, and Rains Urban Land Complex Series soils consisting of poorly drained sandy loam as described in the Phase I RI Report (Solutions-IES, 2008). The typical soil sequence consists of approximately 5 inches of gray sandy loam overlying several feet of red silty clay, with a Unified Soil Classification System (USCS) designation of "CL", that transitions with increasing depth into slightly clayey or slightly gravelly sand

mixtures (SC and SP) containing low but varying amounts of phosphatic sand grains, which is underlain by a semi-confining clayey-silt residuum (ML) that extends from approximately 30 to 55 feet (ft) below ground surface (bgs). The weathered bedrock zone occurs from approximately 55 to 64 ft bgs, which is from the bottom of the clayey-silt residuum to the top of the competent bedrock.

### 2.1.2 Hydrogeology

The conceptual hydrogeologic model for the Piedmont is based on a sloped aquifer system where precipitation infiltrates through the unsaturated zone to recharge the water table. Groundwater moves down slope in response to gravity and discharges as springs in the topographic lows and as base flow to perennial streams and rivers. In most cases, the water table surface mimics the overlying land surface and surface topography can be used to estimate groundwater flow direction.

The Piedmont aquifer system at the former Eaton site is divided into three groundwater transport zones. These zones include the surficial semi-confined unconsolidated zone, the underlying sand and gravel zone, and a highly weathered portion of the underlying bedrock. The sand and gravel zone and the competent bedrock are separated by the semi-confining clayey-silt residuum mentioned above, and then followed by the weathered bedrock zone to the top of the competent bedrock.

A total of 13 permanent monitoring wells have been installed at the site. Eleven of the site wells are screened in the sand and gravel layer above the consolidated clayey-silt residuum, while two monitoring wells (MW-14 and MW-15) have been installed to the top of weathered bedrock. **Table 1** summarizes the screen depths for the site wells that are shown on the current site layout provided as **Figure 2**.

### 2.1.3 Groundwater Flow

The clay unit ("CL") occurs approximately 6 to 12 ft bgs as shown in the cross-section provided as **Figure 3**. The clay layer contributes to the surficial aquifer's semi-confined characteristics, which is supported by the low hydraulic conductivity, and the seasonal change in groundwater flow based on the depth of the water table. Groundwater tends to fluctuate up into the clay layer during wetter seasons.

During Phase I RI site investigation activities in June and July 2008, generalized groundwater flow beneath the site appeared to be toward the west-northwest. But, groundwater levels at the site have fluctuated over the last few years and prior to the Phase I RI in April 2008, groundwater flow was to the south-southeast. **Figure 4** and **Figure 5** shows recent shallow groundwater elevation maps prepared from the measurements collected in October 2012 and January 2013, respectively. These maps suggest

fluctuation in groundwater flow at the site. In October 2012, flow beneath the property was consistent heading primarily in a south-southwest direction. However, in January 2013, groundwater flow in the northern portion of the site flows similarly to the south-southwest, but flow direction beneath the southern and central portions of the property appears to be toward the north with groundwater flow moving generally toward the northeast corner of the building from either direction.

As part of the Phase I RI, slug tests were conducted on July 16, 2008. The results were presented in the Phase I RI Report and included as an appendix in the Phase II RIWP (Solutions-IES, 2008). The tests were conducted on three permanent monitoring wells: MW-2, MW-4 and MW-5. The hydraulic conductivity (K) values for these three wells were 2.14E-05 ft per second (ft/sec) (1.85 ft per day [ft/day]), 4.91E-05 ft/sec (4.24 ft/day), and 3.55E-05 ft/sec (3.07 ft/day), respectively. The geometric mean of the three K values is 3.34E-05 ft/sec (2.89 ft/day).

Vertical groundwater flow potentials were evaluated by comparing water levels in wells screened at differing depths. The potential between the sand and gravel layer and the residuum (silt) was calculated for the June 2011 data as an upward flow potential of 0.005 ft/ft between MW-4 and MW-14, and downward flow potential of 0.006 between MW-2 and MW-15.

## 2.2 PHASE I REMEDIAL INVESTIGATION RESULTS

Solutions-IES began field activities as part of a Phase I RI in May 2008. Solutions-IES advanced 18 soil borings with direct-push technology (DPT) methods and installed five groundwater monitoring wells. Soil impacts appeared to be primarily limited to the vicinity of the former Oil Storage Building and at various locations along the route of subsurface stormwater conveyance that parallels the northern property line (**Figure 2**). The extent of the soil impacts to the north (off site) were not delineated during the Phase I RI assessment. Soil in the immediate vicinity of the Oil Storage Building and along the underground utilities between the Oil Storage Building and East Preston Street was shown to be impacted, and the conclusion of the Phase I RI was that further soil delineation was needed.

The Phase I RI activities were presented in the Phase I RI Report (Solutions-IES, 2008) and identified a groundwater plume to the north and east (off site), but did not delineate the extent. Because VOCs in groundwater had not been defined laterally, it was possible that the groundwater plume may have migrated north or northwest off the site. The assessment report suggested that below-grade utilities, particularly the stormwater piping, might have influenced the plume's migration in a direction opposite to the apparent local

groundwater flow direction at the time. The conclusion of the Phase I RI was that further groundwater delineation was needed.

## 2.3 PHASE II REMEDIAL INVESTIGATION RESULTS

Solutions-IES began field activities as part of a Phase II RI in April 2009. Solutions-IES performed four field events, including the installation of eight new monitoring wells, six piezometers, over 20 soil borings, 11 temporary monitoring wells, one sediment sample, two surface water samples, and two soil rock cores. In addition to sampling at these locations which included the existing and new monitoring wells, Solutions-IES also gained permission to sample several monitoring wells on the adjacent NSEW Corporation (NSEW) property to the east that are owned by ExxonMobil Environmental Services Company (EMES). The findings were presented in the Phase II RI Report (Solutions-IES, 2012).

As shown on **Figure 6**, the primary soil impacts are located on the north side of the Former Oil Storage Area, and extend to the east in a narrow band possibly influenced by below-grade utility lines like the stormwater piping. **Figure 7** estimates the horizontal and vertical extent of PCE in groundwater at the site. The plumes of other COCs identified at the site, such as TCE and 1,1 DCE, are not expected to extend beyond the PCE plume, so the PCE plume is used to illustrate the extent of groundwater impact at the site. As previously discussed, the movement of primary groundwater impacts in narrow bands to the east away from the Former Oil Storage Area and eventually to the south may be influenced by the preferential pathways created by utility installations in these locations.

As presented in **Section 1.0**, conclusions from the Phase II RI Report included:

- PCE is the primary COC in soil;
- PCE, TCE and 1,1-DCE are the primary COCs in groundwater;
- Other VOCs have been detected in soil and groundwater in excess of either the ISHB PSRGs in soil or the NC 2L Standards in groundwater;
- VOCs in the surface water sample collected in Bawdy Swamp Creek do not exceed the NC 2B Standards;
- Sediment in Bawdy Swamp Creek has not been impacted;
- The horizontal and vertical extent of soil and groundwater impacts have been delineated; and
- SVOCs and metals are not COCs.

## 2.4 PRE-DESIGN INVESTIGATION FINDINGS

Eaton conducted two pre-design investigations (PDIs) at the site in October 2012 and February 2013. A short synopsis of each PDI follows. The data from the PDIs have been used to prepare the design presented in this RAP. Additional details of PDI activities and results will be included in a Pre-Construction Report.

October 2012 Findings:

- Trenching in two areas along the stormwater line along the northern boundary of the property confirmed the transition from silt to clay and showed the SW and SS lines are bedded in soil, not on stone or other potentially more transmissive material.
- The primary COCs in soil and groundwater are PCE, TCE and 1,1-DCE. Concentrations are elevated above both soil and groundwater standards along the entire transect of the sanitary sewer (SS) and stormwater (SW) line from west to east.
- Groundwater fluctuations result in a wide vertical smear zone that can both re-contaminate the groundwater and also smear contamination into overlying soil.
- The conditions in both soil and groundwater are not naturally conducive to enhanced anaerobic bioremediation.

February 2013 Findings:

- In soil, elevated PCE and TCE was measured throughout cores as deep as 12 ft bgs; neither microbes nor functional genes for reductive dechlorination were detected in the soil samples.
- Groundwater from the eastern portion of the site is more acidic than the western areas.
- Total Oxidant Demand (TOD as $KMn0_4$) in unsaturated soil averages 3.2 g/kg; buffering need varies from 1 to 119 meq NaOH/kg in soils.
- TOD in saturated soil below the water table (> 8 ft bgs) is 1.4 g/kg.
- In groundwater, concentrations of both PCE and TCE increase with greater depths between 15 and 28 ft bgs; neither microbes nor functional genes for reductive dechlorination were detected in the groundwater samples.

## 2.5 SITE CONCEPTUAL MODEL

Soil and groundwater beneath the former Eaton Selma site are impacted by both petroleum and chlorinated VOCs (CVOCs). Former surface releases originating in the northern portion of the site likely migrated downward through the clayey (CL) overburden where it encountered groundwater and begins to spread laterally primarily to the east and downward vertically through the underlying sand and gravel layer. During this migration, contamination likely encountered preferential pathways for movement toward the east associated with the stormwater conveyances found along the northern property line. Although no sand or gravel bedding was observed beneath the stormwater and sewer lines during the October PDI, subsurface conduits such as these can nonetheless influence transport throughout the surrounding media because the natural formation of the soil matrix has been disturbed to install utilities.

The movement of contaminants may have also been influenced by gaps between utility pipes as well as the preferential pathways described above. To illustrate, two locations along the stormwater piping downgradient of the primary source area have particularly elevated CVOCs in soil, and although, the cause of these two hot spots in soil is unknown, gaps between pipe junctions were noted in two locations. These gaps could allow liquid from the conduit to flow directly into the surrounding soil and also contribute to the movement of contaminants to the east.

PCE is the CVOC that defines the extent of the groundwater plume, though other chlorinated and petroleum VOCs have also been detected above the 15A NCAC 2L .0200 groundwater standards (NC 2L standards). The PCE plume that exceeds the NC 2L standard of 0.7 micrograms per liter (µg/L) is fairly wide, covering most of the developed portion of the site and extending off site to the north and east. However, the area of greatest impact is a narrow "spine" of high PCE concentrations that runs along the northern and eastern sides of the building. Like soil, the pattern is possibly influenced by the stormwater conveyance system. An area of elevated PCE concentration in groundwater, located about 300 ft east from the presumed primary source area, coincides with the location of the elevated PCE in soil.

As discussed in **Section 2.1.3**, groundwater flow fluctuates at the site, which may explain the apparent widespread distribution of PCE and other COCs in groundwater. The shallow gradient and tight soils explain the slow groundwater movement. If the groundwater flow direction fluctuates throughout the year, then the low concentrations observed on the eastern and southeastern sides of the property may be due to natural groundwater flow fluctuation and may not be influenced by underground utilities. There may also be some residual impacts associated with the former septic tank and drain field (removed in approximately 1967). The locations of these former appurtenances are now under the manufacturing building.

Three stainless steel drive-point piezometers were installed in Bawdy Swamp Creek (**Figure 2**) as part of the Phase II RI in order to evaluate the relationship between creek and groundwater from beneath the property (Solutions-IES, 2012). The piezometers are screened from 4 to 5 ft bgs, which is in the clay layer beneath the creek bed, but above the sand and gravel layer 7 to 8 ft bgs, as depicted in the cross-section provided as **Figure 3**. As shown in **Table 1**, groundwater elevation in these piezometers has appeared to respond to seasonal precipitation, e.g., not measurable (dry) during the summer months in 2010 and 2011, but elevated during wetter spring and fall periods in 2012. These observations suggest that the stream is not hydraulically connected to the primary transport zone of the unconsolidated aquifer beneath the site and moderates its importance as a potential surface water receptor.

In October 2009, a surface water sample was collected from the creek due east of the stormwater outfall and on the east side of East Preston St. Several minor detections of CVOCs were noted, including 1.7 µg/L PCE and 1.5 µg/L TCE (Solutions-IES, 2012), but none exceeded the NCAC 2B surface water standards. Detections of these VOCs in the surface water sample were surmised to be primarily related to the stormwater conveyance system that discharges to the ditch (that forms part of the creek) adjacent to East Preston Street, and not impact from groundwater discharge to the creek.

## 2.6 RECEPTORS

### 2.6.1 Receptor Survey

During an Environmental Site Assessment (ESA) conducted by Mid-Atlantic Associates, Inc. (MAA) (MAA, 2008), no water supply wells were reported in the vicinity of the facility. However, during the initial site reconnaissance conducted by Solutions-IES, one water-supply well was observed approximately 1,000 ft south of the site near a vacant house. During May and June 2008, it was observed that the vacant house was no longer present and the well observed previously could not be located. Reportedly, the house had been used by the Johnston County Fire Department for practice.

For preparation of the Phase II RI, Solutions-IES contacted the Town of Selma in December 2011 to update the locations of the Town's water supply wells. The current water supply wells are located north and west of the site. These wells are screened both in the Upper Cape Fear Formation and the underlying slate bedrock at an approximate depth of 300 ft bgs. The water supply wells are not located within the 1,500 ft radius surrounding the site (Solutions-IES, 2012).

### 2.6.2 Sensitive Environments Survey

During the Phase I RI activities (Solutions-IES, 2008), a sensitive environments survey performed by the NCDENR Division of Water Quality (DWQ) and the U.S. Army Corp of Engineers (USACE) reported this area to be environmentally sensitive. The DWQ made their determination because Bawdy Swamp Creek is a tributary to the nutrient sensitive Neuse River. However, Bawdy Swamp Creek flows approximately 15.75 miles from the site before it drains into the Neuse River. Additionally, the USACE determined that the site does contain wetlands.

## 3.0 STATEMENT OF REMEDIAL OBJECTIVES

Groundwater at the former Eaton Selma site is impacted by dissolved phase VOCs. The Phase II RI Report specified PCE, TCE, and 1,1-DCE as the primary COCs for groundwater, but six other CVOCs (carbon tetrachloride [CT], 1,1-dichloroethane [1,1-DCA], 1,2-dichloroethane [1,2-DCA], *cis*-1,2-dichloroethene [*c*DCE], 1,1,1-trichloroethane [TCA] and 1,1,2-trichloroethane [1,1,2-TCA]), two petroleum VOCs (benzene and 1,2-dichlorobenzene [1,2-DCB]) and one trihalomethane VOC (dibromochloromethane) were also reported as exceeding their respective NC 2L standards. The remedial goal of the site is to ultimately lower the concentrations of COCs to below the NC 2L standards (**Table 2**). However, because the concentrations of PCE, TCE and 1,1-DCE are the highest, both historically and currently, across the site, remediation of these COCs is considered as the essential driver for achieving site goals.

Both chemical and biological remediation approaches are applicable for PCE, TCE, and 1,1-DCE removal. Chemical processes, such as *in situ* chemical oxidation (ISCO), completely destroy the contaminant and produce no daughter products. On the other hand, biological processes, including enhanced reductive dechlorination and monitored natural attenuation (MNA), do produce intermediates that must also eventually be degraded. Combination technologies, such as *in situ* chemical reduction (ISCR) create strong reducing conditions that support both chemical and biological reactions. While the primary goal is to reduce PCE, TCE and 1,1-DCE concentrations to below the NC 2L standards, the degradation daughter-products of PCE and TCE (i.e., cDCE and VC) are also included in **Table 2** since these may be formed during biological remediation processes.

## 4.0 SCREENING OF REMEDIAL ALTERNATIVES

This section provides a detailed description of several technologies that were considered for potential application to the groundwater contamination at the former Eaton Selma facility. The technologies were initially screened according to the following criteria:

- effectiveness (i.e., the potential performance of the technology in meeting remedial objectives);
- implementability (i.e., the necessary activities and relative degree of difficulty to install and operate the technology); and
- cost (i.e., high, medium, or low in comparison to other technologies).

Since PCE, TCE and 1,1-DCE are the primary COCs, technologies will be discussed in terms of applicability to these constituents. The technologies fall into three categories: mechanical/physical, chemical and biological.

## 4.1 MECHANICAL/PHYSICAL APPROACHES

### 4.1.1 *In Situ* Air Sparging

*In situ* air sparging (AS) is the injection of air into groundwater at a high volume and flow rate to volatilize contaminants. The air moves through saturated zone subsurface channels where contaminants are also potentially located, and can strip many VOCs including PCE, TCE and 1,1-DCE from the impacted groundwater. Because the volatilized constituents are typically mobilized into the unsaturated zone, air sparging is often done in conjunction with soil vapor extraction (SVE) to capture the vapor phase constituents and prevent their migration into ambient air or subsurface voids (such as basements). Treatment of the vapor phase effluent with activated carbon is often required to reduce VOC emissions. A series of air sparging points finished in the saturated zone would be needed to inject air, and a series of extraction points finished in the unsaturated zone would be needed to extract vapor. Support equipment would include blowers and piping.

Air sparging has demonstrated effectiveness at remediating groundwater impacted with chlorinated hydrocarbons and would be effective at removing PCE, TCE, 1,1-DCE and other secondary COCs from groundwater in the sand and gravel layer and could eventually achieve levels below the NC 2L Standard. Site-specific performance would be dependent upon the local hydrogeologic conditions and the radius of influence in the subsurface, soil organic content, and operating parameters (air flow rate) of the system. However, high capital costs to install the equipment along with long term O&M concerns and costs associated with this technology makes this alternative a less feasible option for the site, and so it will not be evaluated further.

### 4.1.2 Groundwater Recovery with Aboveground Treatment

Aboveground treatment can be performed in several ways: air stripping is essentially the same process of volatilizing VOCs from groundwater as described for air sparging in Section 4.1.1. The difference between the two technologies is the approach to introducing the air to the groundwater. Where air sparging is an *in situ* technology that involves delivering air to the subsurface, air stripping requires removing groundwater from the subsurface and allowing it to flow through an aboveground air stripper. The air stripper is typically a column or tray that is packed with inert media (to increase turbulence) and

an air blower. Extracted groundwater generally flows through the column from top to bottom and VOCs are volatilized from the water. If necessary, the vapor is captured and treated by activated carbon or catalytic converter before release to the atmosphere. Alternatively, the extracted groundwater could be treated through carbon absorption cells. The carbon would need to be changed if and before breakthrough occurred. Finally, extracted water could simply be discharged to the sanitary sewer system or to nearby surface water, pending permit approval.

The groundwater extraction process has the capability of creating hydraulic control and limiting further contaminant transport. However, it is very equipment intensive; requiring a series of vertical or horizontal wells, pumps and piping. It does, however, allow for targeted extraction of groundwater from designated design depths. The type and spacing of extraction wells are dependent on site-specific hydrogeology and the target zone. After the water is treated in the aboveground component and VOCs are removed, it needs to be managed either by re-injecting to the subsurface (requiring an underground injection control [UIC] permit), discharging to a wastewater treatment plant, or by discharging to a nearby surface water (requiring a National Pollution Discharge Elimination System [NPDES] permit). Because of its cost relative to the other viable remedial technologies, potential long term operation and maintenance (O&M) concerns, and potential permitting issues, groundwater pump-and-treat will not be further evaluated as a remedial alternative for this site.

## 4.2 CHEMICAL TREATMENT APPROACHES

### 4.2.1 *In Situ* Chemical Oxidation

*In situ* chemical oxidation (ISCO) typically involves reduction/oxidation (redox) reactions that chemically convert hazardous constituents to less toxic compounds that are more stable, less mobile, or inert. Redox reactions involve the transfer of electrons from one compound to another. Specifically, one reactant is oxidized (loses electrons) and one is reduced (gains electrons). Oxidation can quickly degrade chlorinated solvents without creating decomposition and formation of other intermediate contaminants. Depending on the amount of oxidant introduced, chlorinated constituents can be completely oxidized to inorganic chloride in a relatively short time. The oxidizing agents most commonly used for treating chlorinated compounds (such as PCE, TCE and 1,1-DCE) in the subsurface are ozone, hydrogen peroxide, potassium permanganate, sodium persulfate, and Fenton's reagent (hydrogen peroxide and iron). This technology is generally applied *in situ* for the treatment of groundwater, and has been used at sites with both high and relatively low (<100 µg/L) concentrations of chlorinated VOCs. No vapors are generated and no effluent needs to be managed, eliminating consideration of secondary treatment and

water discharge permits. As with other subsurface injection technologies, the type and spacing of injection points is dependent on site-specific hydrogeology. A major limitation of ISCO is its relatively short-lived presence and activity in the aquifer before it dissipates requiring another injection. A higher level of personal health & safety protections is required as the strong oxidants can be dangerous to handle. This technology usually requires multiple injections, which can become very costly; however, this technology will be further evaluated as a remedial alternative for this site. As with other source area treatments, downgradient areas outside the immediate treatment zone will rely on MNA to achieve long term success throughout the site.

### 4.2.2 *In Situ* Reduction

*In situ* Chemical Reduction (ISCR) is usually applied in the environment by injecting chemically reductive additives in liquid form into the contaminated area or placing a solid medium of chemical reductants in the path of a contaminant plume. Historically, iron wall permeable reactive barriers (PRBs) composed of granular, micro, and zero-valent iron (ZVI) are the best known examples of ISCR technologies. Recent advances in groundwater remediation have led to injectable products that promote ISR for near term treatment of elevated concentrations of CVOCs. During ISCR, one of the reactants in the reaction becomes oxidized, or loses electrons, while the other reactant becomes reduced, or gains electrons. In ISCR, reducing compounds, ( i.e., compounds that accept electrons given by other compounds in a reaction), are used to change the contaminants into harmless compounds without the production of intermediates. Injected reagent may directly reduce the COCs, or produce reduced iron and sulfur minerals that degrade the contaminants through surface mediated reactions. Besides granular, micro, and nano ZVI, other reactants included dithionite, hydrogen sulfide ($H_2S$), and calcium polysulfide (CaPS). These quickly convert the aquifer to a reducing environment and the chlorinated solvents are degraded through two main pathways: beta elimination and reductive dechlorination. With injectable reagents, ISCR can be used also for source area treatment grids or hot spot remediation. The limitation of these chemical reductants, alone, includes their relatively short life in the aquifer.

The application of this technology has evolved to include a combination of chemical reduction and enhanced reductive biodegradation (see Section 4.3.2 below). This has collectively been referred to as *in situ* reduction (ISR), because it employs both chemical and biological components. By applying the combination, ISR can potentially chemically reduce COC concentrations in the short term and then provide organic substrate (and bioaugmentation culture, as needed) for the long term reduction of COCs. Siimilar to *in situ* biological approaches alone (see Section 4.3.2), during ISR, contaminant mass is not transferred to another phase, there is no secondary waste stream to treat, and potential risks related to

exposure during remediation are minimal. In addition, there is little impact on existing infrastructure, and relatively no O&M. Thus, ISR will be retained for further analysis. Aggressive mitigation of high concentrations in the source areas also serves to improve the effectiveness of MNA in areas apart from the primary treatment zones.

## 4.3 BIOLOGICAL TREATMENT APPROACHES

### 4.3.1 Monitored Natural Attenuation

Monitored Natural Attenuation (MNA) is a groundwater remedy that employs the natural processes of dilution, volatilization, biodegradation, adsorption, and chemical reactions within subsurface materials to reduce contaminant concentrations to acceptable levels. The *Guidance on Developing a Monitored Natural Attenuation Remedial Proposal for Chlorinated Organics in Ground Water* (North Carolina Division of Waste Management [NCDWM], 2000*)* states there are three lines of evidence for demonstrating natural attenuation of chlorinated organics in groundwater: 1) observed reduction in mass and concentration; 2) identified and quantified natural attenuation processes; and 3) microcosm studies.

To assess the effectiveness of natural attenuation requires routine monitoring over an extended period of time to obtain sufficient data to perform data trend analysis and statistical evaluation to show plume stability or degradation. As shown in **Table 3**, there have been relatively few groundwater sampling events at the Selma site, which makes these important evaluations problematic. Without more historical data, changes in concentration as a result of natural degradation cannot be determined reliably, and the processes responsible for any observed change(s) cannot be identified with confidence. Microcosm studies have not been performed to evaluate biological contributions, but based on the MBT results from the PDIs, there is little evidence of a dechlorinating bacteria population or functional genes that would support anaerobic reductive dechlorination of the primary COCs to daughter products. Further, the presence of 1,1-DCE can be evidence of non-biological breakdown of TCA, suggesting other mechanisms of degradation are at work.

MNA also requires some degree of source removal to minimize the potential for continuing and long term re-contamination of the aquifer. Although the source material at the Selma site (i.e., the heavily contaminated soil overlying the sand and gravel layer) has not yet been addressed, it is intended that it will be under a separate soil-only RAP that will be prepared in the future. Nonetheless, the current data and site information suggests that solely applying MNA to the entire plume as it is currently configured would not be a viable remedy for this site. However, MNA is a well-documented approach for the long

term monitoring component following or in conjunction with and active remediation approach. For this reason, MNA will be retained, but only in conjunction with other technologies discussed below.

### 4.3.2 *In Situ* Enhanced Reductive Dechlorination

The process of stimulating biological degradation of PCE and TCE is known as enhanced reductive dechlorination (ERD). Contaminant mass is not transferred to another phase, there is no secondary waste stream to treat, and potential risks related to exposure during remediation are minimal. In addition, there is little impact on existing infrastructure, relatively no O&M and replenishment is less costly, should it become necessary. In this process, the chlorinated contaminants are electron acceptors and require that an appropriate electron donor be present in the presence of appropriate microorganisms for the biodegradation to occur. The most common electron donor in this process is hydrogen, which may be produced via primary or secondary fermentation of a variety of organic substrates that are naturally occurring or introduced to the subsurface. Hydrogen ($H_2$) is the electron donor that is oxidized, and the chlorinated solvent is the electron acceptor that is reduced. Potential sources of molecular hydrogen at the Selma site could include natural organic matter and some small amounts of fuel hydrocarbons that have been reported in soil and groundwater. But, to effectively drive the reaction, organic substrates can be injected to engineer favorable site conditions. Introduced substrates that have been used commercially specifically for remediating chlorinated compounds have included sugars such as lactate, molasses and emulsified food-grade vegetable oils that can ferment to produce short-chain fatty acids and excess hydrogen.

An aquifer that is undergoing reductive dechlorination should have the following characteristics:

- A pH in the preferred range of 5.5 to 8.0 standard units (SUs) for biological activity;
- Low dissolved oxygen ( DO <0.5 milligrams per liter [mg/L]),
- Low oxidation-reduction potential (ORP <-100 millivolts [mV]),
- Low concentrations of nitrate and sulfate,
- Elevated total organic carbon (TOC > 20 mg/L), and
- An active dechlorinating microbial community.

Compared to these optimal conditions, current conditions at the site do not lend themselves to supporting reductive dechlorination. The conditions in the shallow aquifer are summarized below from **Table 4**.

- The pH has ranged from 3.2 to 6.5 SUs, with an average of 4.9 SU (MW-5 data from July 2010 not included because pH results appeared to be an anomaly); lower than average pH was observed in monitoring wells MW-1, MW-3, MW-4, MW-8, and MW-9.

- DO ranged from 0.2 to 3.0 mg/L, with an average of 0.9 mg/L.
- ORP ranged from -94 to 413 mV, with an average of 146 mV.
- Nitrate, sulfate, and TOC were not measured.

In addition, groundwater collected from 20 ft bgs in a temporary well installed adjacent to MW-2 during the PDI in February 2013 contained fewer than 10 *Dehalococcoides* sp. (DHC) cells, or cells with TCE-reductase and VC-reductase functional genes, per milliliter.

ERD is used effectively to treat source areas or to control migration of dissolved contaminants. Although the current site conditions do not lend themselves to reductive dehalogenation, re-engineering the aquifer in the source areas along the storm water and sewer lines along the northern boundary of the site and down along East Preston St. into an anaerobic, reducing environment is possible and can be an effective, less costly means of supporting appropriate dehalogenating bacterial communities. Implementing an enhanced bioremediation technology at this site will require an underground injection control (UIC) permit to allow injection of a substrate capable of converting aquifer geochemistry to make it conducive for anaerobic reductive dechlorination to occur, and adding specialized bacteria to the aquifer (bioaugmentation) to ensure the needed microbial community is present. The permit will also need to address the injection of buffering material to help raise the pH of the aquifer to a range more suitable for ERD.

Typically, less contaminated areas downgradient or away from the immediate treatment zone are designed to rely on MNA. Because this approach can be done successfully, this approach will be retained for further consideration.

## 4.4 PERMEABLE REACTIVE BARRIER VS. GRID DESIGNS

Both ISR (Section 4.2.2) and ERD (Section 4.3.2) are approaches for establishing *in situ* reduction zones capable of either chemically and/or biologically degrading down the COCs. PRBs and grid designs are typical layouts capable of bringing the substrate or reactant in contact with the COCs. Permeable reactive barriers (PRBs) are engineered barriers installed in the subsurface across the flow path of a groundwater plume. When considering installation of a PRB, it is very important to have a strong indication of groundwater flow direction. Where this is not clear, such as at the Former Eaton Facility, grid designs offer broad distribution of substrate in the aquifer and hot spot remediation. Both PRBs and grid designs refer to the layout of the treatment zone rather than to the technology employed within the barrier.

PRBs present a more uniform front through which the contaminated groundwater must flow. Grids can result in gaps between injection points. In either design, the aqueous portion of the plume flows through the treated zone where contaminants are chemically or biologically inhibited from further migration as a result of treatment within the zone. Contaminant movement is inhibited by employing agents or reactants such as ZVI, chelators, sorbents or substrates that degrade or retain contaminants. PRBs constructed as trenches are usually employed in shallow contamination situations with good site access because of their relative effective longevity and minimal O&M cost once they are installed. However, if treatment times extend beyond several years, the barrier material may need to be replaced or replenished periodically if it loses its reactive capacity and/or becomes impermeable. PRBs can also be formed by injection using closely spaced injection points to create overlapping zones of influence. These can be installed deeper and in areas of less accessibility because they rely on injection wells rather than trenching.

PRBs and grid designs using either chemical and bioactivity-promoting materials have been used effectively at many sites for treating the suite of chlorinated solvents such as the COCs at the Former Eaton Facility site. For example, ZVI barriers are used to stimulate chemical reduction processes by using iron granules or filings incorporated with an inert material to fill the trench. As the iron is reduced, a chlorine atom is removed from the contaminant by one or more reductive dechlorination mechanisms, using electrons supplied by the reduction of iron. With proper engineering, conditions can be created that will effectively chemically reduce the chlorinated ethenes resulting in decontaminated water emerging from the downgradient side of the PRB. At the Former Eaton Facility, the potential for elevated dissolved iron to develop downgradient of the iron wall should not be a secondary water quality concern, since groundwater flow velocity is slow and there are no nearby receptors that could be impacted. The iron granules are slowly dissolved by the process, but the metal disappears so slowly that the remediation barriers can be effective for many years. However, regeneration of an iron wall can be costly, if it becomes necessary.

Emulsified oil substrates are also effective in PRB and grid configurations. Biological PRBs can be established by backfilling an interceptor trench with mulch with or without added substrate, or simply by injecting substrate with spacing close enough to form a continuous treatment zone along and throughout the desired depth interval. As contaminated groundwater passes through the trench or treatment zone, some of the contaminants are sorbed into the oil phase, which extends contact time between the contaminant, the substrate, and the microorganisms. This is particularly beneficial when starting concentrations are elevated, as seen at the Former Eaton Facility. With proper engineering, conditions

can be created that will effectively biodegrade the chlorinated ethenes resulting in decontaminated water emerging from the downgradient side of the PRB.

The issue with using a PRB at the former Former Eaton Facility site is the low hydraulic conductivity and the seasonal change in groundwater flow based on the depth of the water table. Installing a PRB does not guarantee that groundwater will flow in the direction to the PRB. Also, building a PRB to depths of 30 ft bgs would result in very costly construction and extended site disruption. Therefore, PRBs will not be retained for further discussion. Instead, injection of substrate and/or chemical reactant in a grid formation will be evaluated. This allows for greater spacing and greater depths. The installation of permanent injection wells as part of the design allows for future replenishment of the aquifer, if needed, with minimal site disturbance.

## 5.0 FEASIBILITY STUDY

Based on the discussion in Section 4.0, three technologies were ruled out from further consideration: air sparging, groundwater extraction and treatment, and either chemical or biological trench/wall PRBs. Four technologies were retained for further consideration: ERD, ISCO, ISR and MNA. However, MNA was determined to be largely unacceptable as a stand-alone groundwater remedy because starting concentrations in the source areas are elevated, and native aquifer conditions are not conducive for either biological or abiotic changes to occur, particularly in a measurable timeframe. However, MNA is discussed separately and retained as a component of ERD, ISCO and ISR, where it does have potential to address low residual concentrations outside the primary treatment areas.

This section presents additional details regarding the three applicable alternatives for groundwater impacted by VOCs at the Former Eaton Facility. The evaluation of the groundwater alternatives is based on the presumption that the soil remedy to be implemented will address the most heavily contaminated soil areas and, therefore, reduce some of the contamination diffusing from the clay matrix. Each alternative is evaluated with the feasibility study criteria specified in the REC Implementation Guidance rule .0306(l) 3 (A) through (H). **Table 5** presents a summary and comparison of the remedial alternative evaluation and the proposed remedy is presented in **Section 6.0**.

## 5.1 MONITORED NATURAL ATTENUATION

MNA has been retained as a potential remedial alternative for groundwater in combination with an active remediation alternative to reduce the concentrations of PCE, TCE and 1,1,-DCE. These COCs are amenable to natural attenuation (NA) under certain subsurface conditions. Currently, not enough data are available to evaluate contaminant concentrations trends and subsurface conditions that would be conducive to NA. To support MNA as a stand-alone remedial alternative, a more extensive data set (including both geochemical and biological parameters) would be required along with trend analysis, fate-and-transport modeling and statistical evaluations of plume changes over time.

### 5.1.1 Protection of Human Health and the Environment

As discussed in the Site Conceptual Model in Section 2.5, Bawdy Swamp Creek is not believed to be hydraulically connected to the underlying sand and gravel layer and not a groundwater discharge feature or receptor of concern at the site. No known water supply wells are located within 1,500 feet of the site. The slow groundwater flow and fluctuating flow direction would tend to suggest that MNA, in combination with active remediation near the presumed source areas, could possibly result in COC attenuation over time eventually achieving the NC 2L Standards in groundwater in areas downgradient of the source. Tracking NA with an appropriate performance-monitoring program would be protective of human health and the environment as trends become apparent that could be used to predict fate-and-transport.

### 5.1.2 Compliance with Federal, State, and Local Regulations

Employing MNA as the preferred groundwater remedy would not require any Federal, state or local permits (except for those necessary to install any additional monitoring wells, which are not recommended at this time). Therefore, this alternative is expected to comply with Federal, state, and local regulations.

### 5.1.3 Long-term Effectiveness

MNA alone would not be expected to meet the remedial objectives for the site in the source areas. Without evidence of biological processes or without chemical or biological enhancement, this area of the site will remain a continuing groundwater source to the plume. In areas away from the source, MNA may be expected to be moderately effective. Even with limited biological participation, abiotic factors such as dilution and dispersion can result in slow decreases in concentration. An advantage of MNA is that once

the NC 2L Standards are achieved in groundwater, no constituent "rebound" is expected, and the remedy should be effective over the long-term and would be permanent.

#### 5.1.4 Reduction of Toxicity, Mobility, and Volume

The NC 2L Standard for PCE is based on its human carcinogenicity. Allowing NA to continue until the NC 2L Standards are met would reduce the concentrations of CVOCs to levels that would not be a cancer threat or hazard to humans or to the environment. Continued monitoring would verify that no further migration is occurring. The concentration and volume of residual CVOCs in groundwater would be depleted and impacted groundwater would be reduced due to attenuation over time.

#### 5.1.5 Short-term Effectiveness (≤ 5 years)

MNA would not achieve the remedial objective of meeting the NC 2L Standard for the COCs over the short-term. However, there are no immediate downgradient receptors and monitoring should verify the lack of migration.

#### 5.1.6 Implementability

Implementing MNA would require continued site access for monitoring and well maintenance purposes. There are no current obstacles to implementing this remedy. The monitoring program for the site would involve quarterly monitoring during the first year of implementation, followed by semiannual monitoring and reporting to year 5, and then annual monitoring and reporting (assumed for 30 years total).

#### 5.1.7 Cost

The following table summarizes the estimated costs associated with utilizing MNA as the remedial technology at the site. The remedy requires no operating equipment or any additional construction. MNA has been retained in combination with active remediation within the presumed source area. The cost below does not include active remediation. For estimation purposes, performance monitoring is assumed to be conducted quarterly during Year 0, semi-annually for Years 1through 5, and annually to 30 years. Costs are escalated at a rate of 4 percent a year and then discounted at 7 percent to calculate a net present worth. Detailed cost estimates are provided in **Appendix A**.

| Items | Net Present Worth |
|---|---|
| MNA Year 0 Quarterly Monitoring and Reporting | $79,000 |
| Years 1 through 5 Semi-Annual Monitoring and Reporting | $180,000 |
| Years 6 through 30 Annual Monitoring and Reporting | $300,000 |
| **Total Net Present Worth Cost for 30 Years of MNA** | **$558,000** |
| **Net Present Worth Cost Range (+15%/-10%)** | **$642,000 - $503,000** |
| **Total Dollars** | **$1,330,000** |
| **Total Dollars Cost Range (+15%/-10%)** | **$1,530,000 - $1,200,000** |

### 5.1.8 Community Acceptance

The site activities associated with remediation are not expected to disturb the community and implementing MNA as part of the overall groundwater remedy is expected to be acceptable to the community. This remedy does allow residual COCs to remain in place for many years until it attenuates. The land use on the site is industrial with residential zoning to the southwest. However, Eaton does not own the land, and the current property owners are aware of the environmental impacts and have been cooperative with investigation and monitoring activities. The expectation is that cooperation with the property owners will continue in the future, though the situation may need to be reviewed if property owners or land use changes.

## 5.2 *IN SITU* BIOREMEDIATION IN SOURCE AREA WITH MNA

The design of this treatment approach is two-fold: 1) inject an emulsified oil product to treat the most heavily impacted PCE-contaminated groundwater in the presumed source area and along the stormwater conveyance system, and 2) implement MNA outside of the injection area. An emulsified oil has potential for reducing the concentrations of PCE in groundwater and accelerating biodegradation to meet remedial objectives for this site. The challenge, however, will be in addressing matrix diffusion from the clay layer located near the soil – groundwater interface. Therefore, Solution-IES is proposing to add an extended time-released emulsified oil (EOS XR[1]) to the sand and gravel layer beneath the clay layer to gradually release electron donors over a decade to treat CVOCs that will slowly diffuse out of the clay. In this approach, a grid type design will be implemented covering an approximate 41,750 square foot area located near the presumed source area and following the stormwater conveyance system along the northern property line and then heading south along the west side of East Preston Street, as shown in **Figure 8**. Solutions-IES would hire a subcontractor to install approximately 60 injection wells screened

[1] EOS XR and CoBupH-Mg™ are products of EOS Remediation, LLC. EOS XR has been approved for use at this site and in North Carolina in correspondence received from the NCDENR Division of Public Health dated April 17, 2013. CoBupH-Mg was approved for use in North Carolina on October 16, 2012.

from 10 to 20 and 20 to 30 ft bgs and five additional monitoring wells (shown as MW-16 through MW-20) screened from approximately 15 to 25 ft bgs. Solutions-IES would then inject approximately 60,500 pounds of the extended time-released emulsified oil substrate. Due to the low pH in much of the injection area, Solutions-IES will also inject approximately 8,400 pounds of a colloidal buffer such as CoBupH-Mg™ to increase the pH to more favorable conditions for bacteria. The volume per well would be approximately 8,500 gallons. Bioaugmentation culture will also be injected once the aquifer pH has increased. The EOS XR substrate is designed to have a lifespan in the aquifer of up to 10 years, which is greater than other commercially available vegetable oil emulsion products.

### 5.2.1 Protection of Human Health and the Environment

*In situ* bioremediation is expected to immediately reduce CVOC concentrations in the groundwater source areas resulting in reductions in the plume over time, eventually achieving the NC 2L Standards in groundwater beneath the site. MNA would still be required to monitor concentrations outside of the injection area. Tracking NA with an appropriate performance-monitoring program would be protective of human health and the environment as trends become apparent that could be used to predict fate-and-transport.

### 5.2.2 Compliance with Federal, State, and Local Regulations

A UIC permit would be needed to install the injection wells and add the substrate, buffering material and bioaugmentation culture. Monitor well permits may be required for new wells as the property is no longer owned by Eaton. After implementation, changes to COC concentrations will be measured against the NC2L standards. Geochemical changes will be evaluated with regard to secondary water quality standards, as applicable.

### 5.2.3 Long Term Effectiveness

The emulsified oil injection would be mainly used as a treatment for groundwater in the presumed source areas and along the stormwater conveyance system, whereas MNA would still be the main remedy for outside of the injection area. Emulsified oil products are available that are designed to last a number of years to continue to treat contaminated groundwater, as well as contamination that bleeds into the aquifer from lower permeability zones (back diffusion). EOS XR is specifically designed to provide greater longevity and extended effectiveness (up to 10 years without replenishment) than other commercially available emulsified oil products. Bacterial culture, once established, should remain viable in the anaerobic reducing conditions created by the addition of substrate and buffer.

### 5.2.4 Reduction of Toxicity, Mobility, and Volume

The toxicity of PCE, TCE and 1,1-DCE in the groundwater will be slowly reduced as the compounds are metabolized. Contaminant mass flux in the presumed source area will be reduced. NA processes outside of the presumed source area will continue to be responsible for controlling further migration. Therefore, this alternative will reduce toxicity, mobility and volume of the COCs.

### 5.2.5 Short-term Effectiveness (≤ 5 years)

Once anaerobic conditions and a viable dehalorespiring population are established, the treatment would be expected to become effective. Typically, these changes can be observed within 6 to 9 months post-injection, if not sooner. The formation of daughter products of biodegradation would require monitoring, but these would be expected to degrade over time, as well. Engineering the amount of substrate that should be injected in each well and how much chase water to effectively disperse the product is important for establishing the appropriate contact time for biodegradation of the CVOCs to occur. In general, emulsified oil injections have a proven track record of effectiveness for 3 to 5 years without replenishment. Because the starting concentrations of PCE, TCE and 1,1-DCE are very high in the source areas and along the subsurface conveyances, it may be overly optimistic to expect complete remediation within 5 years. However, a substantial reduction in concentration and mass would be expected over that period.

### 5.2.6 Implementability

This alternative will require subcontractors and equipment that are readily available to install injection and monitoring wells. Underground utilities at the site could pose potential problems during injection well installation. Upon acquiring a UIC permit from the NCDENR, construction of the wells will begin. Well installation is estimated to take 2 weeks and substrate injection is anticipated to last approximately 4 weeks. The use of permanent injection wells allows for future replenishment, as needed. Should replenishment in some areas be need approximately 10 years after initial application, these wells will be available, simplifying this task at that time.

### 5.2.7 Cost

The following table summarizes the estimated costs associated with utilizing EOS XR, CoBupH-Mg™ and a bioaugmentation culture in the presumed source and along the stormwater conveyance system and MNA in outlying areas as the groundwater remedy at the site. The costs are based on approximately 60 injection wells and the installation of five additional monitoring wells to monitor the effectiveness of ERD. The volume of product calculation is based on a 15 foot radius of influence (ROI) and 20 foot

treatment thickness. We have also assumed that injection of one-half the original volumes of substrates will be conducted in Year 10 to rejuvenate, replenish and enhance selected areas of the plume. For estimation purposes, monitoring along the treatment area as well as MNA monitoring downgradient is assumed to be conducted quarterly during Year 0, semi-annually for Years 1 through 5, and annually to Year 15. Costs are escalated at a rate of 4 percent a year and then discounted at 7 percent to calculate a net present worth. Detailed cost estimates are provided in **Appendix A**.

| Items | Estimated Cost |
|---|---|
| *In Situ* Bioremediation Injection and Post-Injection Monitoring | $522,000 |
| ERD Substrate Reinjection (Year 10) | $93,000 |
| Year 0 Quarterly Monitoring and Reporting | $79,000 |
| Years 1 through 5 Semi-Annual Monitoring and Reporting | $180,000 |
| Years 6 through 15 Annual Monitoring and Reporting | $146,000 |
| **Total Net Present Worth Cost for ERD with MNA** | **$1,019,000** |
| **Net Present Worth Cost Range (+15%/-10%)** | **$1,172,000 - $918,000** |
| **Total Dollars** | **$1,300,000** |
| **Total Dollars Cost Range (+15%/-10%)** | **$1,495,000 - $1,170,000** |

### 5.2.8 Community Acceptance

Implementing ERD remedy is expected to be acceptable to the community. The land use on and around this site is industrial and residential. Implementing this remedy would be construction intensive for a short period, but afterward would not be expected to disturb current business activities or limit future industrial uses as almost all the components are underground. There has been little community interest at this site to date. Eaton does not own the land, and the current property owners are aware of the environmental impacts and have been cooperative with investigation and monitoring activities. The expectation is that cooperation with the property owners will continue in the future, though the situation may need to be reviewed if there is a change in property owner or land is further subdivided.

## 5.3 ISR SOURCE TREATEMENT WITH MNA

The approach discussed in this section is designed to treat the source areas of the plume using ISR, as well as implement MNA outside of the injection area. As described in Section 4.2.2, ISR collectively includes both chemical and biological components. The combination product (e.g., a mixture of emulsified vegetable oil (EVO), nutrients, vitamins, ZVI and bicarbonate buffer[2]) is a concentrated microemulsion of a controlled-release carbon, nutrients, and iron. The iron is used to quickly establish

[2] Formulation and estimated costs provided by OnMaterials, Inc., San Diego, CA.

reducing conditions and start chemical reduction of the COCs. Once the iron is consumed, the carbon can be used by indigenous or added bacteria to continue biodegradation. The design pattern would be similar to that used for *in situ* bioremediation (**Figure 8**). Approximately 60 injection wells would be installed in a grid design in the presumed source area following the stormwater conveyance system along the northern property line and then heading south along the west side of East Preston Street to treat the most heavily contaminated portion of the plume. An additional five monitoring wells would be installed to evaluate the effectiveness of the ISCR injections. Approximately 60,000 lbs of a commercially available EVO product (e.g., EOS® or Newmans Zone) would be mixed with 15,000 lbs of ZVI (e.g., Z-Loy LA) for injection. Approximately 44,000 lbs of bicarbonate buffer would also be used to help control pH. The volume of mixture per well is 6,000 gallons. The injectable material would be expected to have a lifespan in the aquifer of 3 to 5 years, typical of other vegetable oil emulsion products.

### 5.3.1 Protection of Human Health and the Environment

ISR is expected to immediately reduce PCE, TCE and 1,1-DCE concentrations in the groundwater source area and eventually result in reductions in the plume over time, eventually achieving the NC 2L Standards in groundwater beneath the site. MNA would still be required to monitor concentrations outside of the injection area. Tracking NA with an appropriate performance-monitoring program would be protective of human health and the environment as trends become apparent that could be used to predict fate-and-transport.

### 5.3.2 Compliance with Federal, State, and Local Regulations

A UIC permit would be needed to install the injection wells and add the reactant, substrate, buffering material and bioaugmentation culture. Monitor well permits may be required for new wells as the property is no longer owned by Eaton. After implementation, changes to COC concentrations will be measured against the NC 2L standards. Geochemical changes will be evaluated with regard to secondary water quality standards, as applicable.

### 5.3.3 Long-term Effectiveness

Injection of the ISR mixed product would be mainly used as a treatment for groundwater in the presumed source area, along the stormwater conveyance system and along the west side of East Preston St., whereas MNA would still be the main remedy for outside of the injection area. The mixture does provide a carbon source that will last longer than the iron portion of the product; however, the product is not expected to last longer than five years. Therefore, re-injection and replenishment will be required to rejuvenate the treatment area in order to remain effective and address contamination that bleeds into the aquifer from

lower permeability zones (back diffusion). Bacterial culture, once established, should remain viable in the anaerobic reducing conditions created by the addition of substrate and buffer.

#### 5.3.4 Reduction of Toxicity, Mobility, and Volume

The chemical reduction of PCE, TCE and 1,1-DCE will reduce its concentration in groundwater, thereby reducing hazard toxicity and carcinogenicity. Contaminant mass flux in the presumed source area will be reduced. NA process outside of the presumed source area will continue to be responsible for controlling further migration. Therefore, this alternative will reduce toxicity, mobility and volume of the COCs.

#### 5.3.5 Short-term Effectiveness (≤ 5 years)

The inclusion of ZVI in the ISR product is expected to immediately reduce PCE, TCE and 1,1-DCE concentrations near the injection zone. Once anaerobic conditions and a viable dehalorespiring population are established, the bioremediation treatment would be expected to become very effective. Engineering the amount of substrate that should be injected in each well and how much chase water to effectively disperse the product is important for establishing the appropriate contact time for degradation of CVOCs to occur. Re-injection to replenish the aquifer with substrate within five years will likely be required.

#### 5.3.6 Implementability

This alternative will require subcontractors and equipment that are readily available to install injection and monitoring wells. Underground utilities at the site could pose potential problems during injection well installation. Upon acquiring a UIC permit from the NCDENR, construction of the wells will begin. Well installation is estimated to take 2 weeks and substrate injection is anticipated to last approximately 4 weeks.

#### 5.3.7 Cost

The following table summarizes the estimated costs associated with utilizing ISCR with MNA as the groundwater remedy at the site. Costs are based on using the ISR combination of EVO, Z-Loy and bicarbonate, as prepared and injected by OnMaterials, Inc. as a subcontractor to Solutions-IES. The costs are based on approximately 60 injection wells and the installation of five additional monitoring wells to monitor the effectiveness of the treatment. The volume of product calculation is based on a 15 foot radius of influence (ROI) and 20 foot treatment thickness. The design injection flow rate was 1.0 gallons per minute (gpm). We have also assumed that injection of one-half the original volumes of substrates will be conducted in Year 5 to rejuvenate, replenish and enhance selected areas of the plume. For estimation

purposes, monitoring of the treatment zone and MNA downgradient is assumed to be conducted quarterly in Year 0, semi-annually in Years 1 through 5, and annually to Year 15. Costs are escalated at a rate of 4 percent a year and then discounted at 7 percent to calculate a net present worth. Detailed cost estimates are provided in **Appendix A**.

| Items | Estimated Cost |
|---|---|
| ISR Injection and Initial Post-Injection Monitoring | $627,000 |
| ISR Substrate Reinjection (Year 5) | $154,000 |
| Year 0 Quarterly Monitoring and Reporting | $79,000 |
| Years 1 through 5 Semi-Annual Monitoring and Reporting | $180,000 |
| Years 6 through 15 Annual Monitoring and Reporting | $146,000 |
| **Total Net Present Worth Cost for ISR with MNA** | **$1,185,000** |
| **Net Present Worth Cost Range (+15%/-10%)** | **$1,363,000 – 1,067,000** |
| **Total Dollars** | **$1,440,000** |
| **Total Dollars Cost Range (+15%/-10%)** | **$1,656,000 – $1,296,000** |

### 5.3.8 Community Acceptance

Implementing this remedy is expected to be acceptable to the community. The land use on and around this site is industrial and residential. Implementing this remedy would be construction intensive for a short period, but afterward would not be expected to disturb current business activities or limit future industrial uses as almost all the components are underground. There has been little community interest at this site to date. Eaton does not own the land, and the current property owners are aware of the environmental impacts and have been cooperative with investigation and monitoring activities. The expectation is that cooperation with the property owners will continue in the future, though the situation may need to be reviewed if there is a change in property owner or land is further subdivided.

## 5.4 ISCO SOURCE TREATMENT WITH MNA

The approach discussed in this section is designed to install injection wells in the vicinity of the presumed groundwater source area and treat the plume using ISCO. The layout is similar to both *in situ* bioremediation and ISR approaches. Approximately 60 wells would be installed in a grid design in the presumed source area, along the stormwater conveyance system and south along east Preston St. to treat the most heavily contaminated portion of the plume (**Figure 8**). Potassium permanganate ($KMnO_4$) would be the preferred oxidizing agent where elevated concentrations of PCE occur among the other CVOCs of concern. However, $KMnO_4$ has less impact on TCA. Sodium persulfate is a broader oxidant and would be recommended to address the wider range of COCs.

The amount of $KMnO_4$ was calculated based on the volume to be treated and the average TOD in aquifer sediments deeper than 8 ft bgs. Redox Tech, Inc. provided an estimate of time and materials needed to satisfy the TOD and contaminant loading. Approximately 46,300 lbs of $KMnO_4$ reactant would be injected during the initial injection event. Although the immediate impact of the injection would be rapid decrease in concentrations of PCE, TCE and 1,1-DCE, ISCO's effectiveness rapidly dissipates as natural organic material also consumes the reagent and its water solubility make it susceptible to washout of the treatment zone. ISCO applications typically also are subject to contaminant rebound making several injections necessary. Upon recommendation from the vendor, three injections are projected to meet the demand. These would be injected approximately 6 months apart. MNA would still be required as part of the remedy to address areas downgradient from the source.

### 5.4.1 Protection of Human Health and the Environment

ISCO is expected to immediately reduce PCE, TCE and 1,1-DCE concentrations in the groundwater source area and eventually result in reductions in the plume over time. MNA would still be required to monitor concentrations outside of the injection area. Tracking NA with an appropriate performance-monitoring program would be protective of human health and the environment as trends become apparent that could be used to predict fate-and-transport.

### 5.4.2 Compliance with Federal, State, and Local Regulations

A UIC permit would be needed to install the injection wells and add the reactant solution. Monitor well permits may be required for new wells as the property is no longer owned by Eaton. After implementation, changes to COC concentrations will be measured against the NC 2L standards. Geochemical changes will be evaluated with regard to secondary water quality standards, as applicable. It should be noted that $KMnO_4$ is a strong purple reagent. Although the Site Conceptual Model suggests that Bawdy Swamp Creek is not hydraulically connected to the aquifer and not a discharge feature, pressurized injection of this reactant in areas somewhat near the creek could result in daylighting in the creek.

### 5.4.3 Long Term Effectiveness

Chemical oxidation is generally effective for both low and high concentrations of chlorinated ethenes. This alternative would be expected to have long-term effectiveness at treating contamination, but will require multiple injections to do so. However, downgradient MNA would still be used to reduce and control in concentrations.

### 5.4.4 Reduction of Toxicity, Mobility, and Volume

The chemical oxidation of COCs will reduce its concentration in groundwater. Consequently, the volume of COCs will be reduced. Reductions in concentration will reduce potential toxicity and carcinogenicity of groundwater, although no one is expected to contact groundwater and be affected. CVOC mobility is not affected and any CVOC that is not oxidized would continue to remain at the site.

### 5.4.5 Short-term Effectiveness (≤ 5 years)

ISCO is an aggressive approach with excellent short-term effectiveness. This alternative will immediately reduce CVOCs from groundwater. However, ISCO is also known to be subject to contaminant concentration rebound. A short-term disadvantage of this approach is the potential to elevate manganese concentrations in groundwater above the NC 2L Standard, although this would be expected to dissipate over time.

### 5.4.6 Implementability

Upon acquiring a UIC permit from the NCDENR, construction of the system will begin. It will take an estimated two weeks to install the injection wells and up to 40 days to perform the injections. Using permanent injection wells will simplify the re-injection process.

### 5.4.7 Cost

The following table summarizes the estimated costs associated with utilizing ISCO with downgradient MNA as the groundwater remedy at the site. Costs are based on using $KMnO_4$ and a subcontractor performing the injections. The costs in Year 0 include two injection events scheduled 6 months apart and associated monitoring. The third injection event is scheduled in Year 1. For estimation purposes, MNA monitoring is assumed to be conducted quarterly in Year 0, semi-annually in Years 1 through 5, and annually to Year 15. Costs are escalated at a rate of 4 percent a year and then discounted at 7 percent to calculate a net present worth. Detailed cost estimates are provided in **Appendix A**.

| Items | Estimated Cost |
|---|---|
| Two ISCO Injections and Post-Injection Monitoring | $1,044,000 |
| ISCO Injection (Year 1) | $352,000 |
| Year 0 Quarterly Monitoring and Reporting | $79,000 |
| Years 1 through 5 Semi-Annual Monitoring and Reporting | $182,000 |
| Years 6 through 15 Annual Monitoring and Reporting | $146,000 |
| **Total Net Present Worth Cost for ISCO with MNA** | **$1,722,000** |
| **Net Present Worth Cost Range (+15%/-10%)** | **$1,981,000 - $1,550,000** |
| **Total Dollars** | **$1,896,000** |
| **Total Dollars Cost Range (+15%/-10%)** | **$2,181,000 - $1,707,000** |

### 5.4.8 Community Acceptance

Implementing this remedy is expected to be acceptable to the community. The land use on and around this site is commercial and industrial. This remedy would be construction intensive for a short period, but afterward would not be expected to disturb current business activities or limit future residential or industrial uses. There has been little community interest at this site to date. Eaton does not own the land, and the current property owners are aware of the environmental impacts and have been cooperative with investigation and monitoring activities. The expectation is that cooperation with the property owners will continue in the future, though the situation may need to be reviewed if there is a change in property owner or land is further subdivided.

## 5.5 SUMMARY AND COMPARISON OF REMEDIAL ALTERNATIVES

**Table 5** presents a summary and comparison of the remedial alternatives for the Former Eaton Facility. The design for implementation for the three alternatives is similar. Long term monitoring requirements for the three alternatives are also similar. The community that currently surrounds the immediate vicinity of the site is industrial and residential, and the members of this community are not expected to have a strong concern about the length of time needed to achieve the remedial objectives. However, because Eaton no longer owns or controls use of the land, the land use conditions will need to be periodically reviewed to ensure that protection of receptors is maintained.

The technology comparison indicates that MNA does not have strong short-term effectiveness and requires extended time (30 years) to reduce toxicity, mobility and volume of PCE and to achieve overall protection of the environment. The current conditions at the site do not support a strong biological component to MNA, so use of MNA downgradient may rely more heavily on abiotic attenuation factors. A larger data set would be needed to complete groundwater predictive modeling to make a strong case for MNA as a stand-alone remedy. However, MNA can be effective at the Former Eaton Facility if used in combination with other treatment options for the outlying areas of the plume.

ISCO requires at least three injections and is most costly to apply. ISCO also requires additional health and safety precautions during application. $KMnO_4$ is not as suitable for oxidizing some other CVOCs found in site groundwater that other oxidants, such as sodium persulfate, may treat better. Cost of these other oxidants are generally similar or even more expensive than $KMnO_4$. Therefore, ISCO was ranked lowest of the three technologies evaluated.

ISR and ERD are very similar. Both technologies create conditions in the aquifer that are favorable for long term bioremediation. Both technologies provide bioavailable organic carbon that can be fermented to produce hydrogen ($H_2$) and acetic acid that serve as preferred electron donors for reductive dechlorination of the chlorinated ethenes. The ZVI component of ISR also provides quick conversion of the aquifer to reducing conditions and potential for immediate Fe-mediated abiotic degradation of elevated CVOC concentrations in groundwater. However, ISR is expected to have a shorter overall longevity in the aquifer than the extended release ERD product discussed in this RAP.

Because of the technical similarities in the approach, further evaluation of ISR and ERD technologies was conducted to aid in the decision-making process. On a pound for pound comparison of substrate injected, the costs for ISR reactant/substrate/buffer is 25 % higher than and ERD costs for substrate/buffer, and the overall life cycle cost for ISR is 10% higher than ERD. Further, as noted above, anaerobic bacteria rely on $H_2$ and acetic acid to drive reductive dechlorination. The amount of reducing equivalents ($H_2$) produced from the specified amount of EOS XR is about 13% higher than the amount of $H_2$ produced from the combination of EVO and Z-Loy specified for ISR. Approximately 14,000 lbs of $H_2$ is expected to be released from the fermentation of 60,000 lbs EOS XR specified for this remediation. By comparison, the combination of 60,000 lbs of EVO and 15,000 lbs Z-Loy used in the ISR estimate would only be expected to produce 12,000 lbs of $H_2$. Increasing the pounds of EVO plus Z-Loy to obtain the same amount of reducing equivalents as EOS XR would further increase the cost differential between these two technologies. Although both would work well for this application, ERD using EOS XR is practical, logical, tested and more cost competitive and, therefore, was ranked ahead of ISR as the groundwater remedy for the most heavily contaminated areas of the site.

## 6.0 PROPOSED REMEDY

*In situ* bioremediation via ERD, using a longer-lasting emulsified oil (EOS XR) with time-release buffer (CoBupH-Mg™) and bioaugmentation within the presumed source areas, along the stormwater conveyance system and along East Preston St., along with MNA in outlying areas is proposed as the remedy for the COCs in groundwater at this site. The following subsections provide the justification for selecting this remedy, describe design of the remedy in more detail, and describe the monitoring performance criteria that will be used to evaluate effectiveness.

## 6.1 JUSTIFICATION FOR REMEDY SELECTION

The typical soil lithology at the Former Eaton Facility consists of approximately 5 inches of gray sandy loam overlying several feet of red silty clay, that transitions with increasing depth into slightly clayey or slightly gravelly sand mixtures, which is underlain by a semi-confining clayey-silt residuum followed by weathered bedrock that transitions to competent bedrock (**Figure 3**). The PDIs demonstrated that the red silty clay layer with lower permeability contains elevated CVOC concentrations. Until this is addressed in the soil RAP (under separate cover), the soil-water interface is expected to remain a continuing source back-diffusion of CVOCs into the aquifer. Based on the limited historical data set, biogeochemical conditions that would support anaerobic biological natural attenuation processes are not prevalent at this site. Nonetheless, *in situ* bioremediation is a widely accepted technology that can be used effectively to re-engineer the aquifer to an anaerobic, reducing environment that would support the breakdown of CVOCs to non-toxic ethenes (AFCEE et al., 2004; Sale et al., 2008). Tools have been developed to help design the application of the technology (Borden et al., 2008). Thus, despite the initial geochemical limitations, *in situ* bioremediation using an extended release emulsified oil in the source area, in combination with MNA in outlying areas, has strong potential to control contaminant migration, protect nearby receptors from impact, eventually satisfy the remedial goals for the site, and is cost effective when compared to other technologies evaluated.

## 6.2 REMEDY DESIGN

The *in situ* bioremediation portion of the remedy includes the installation of up to 60 injection wells spaced approximately 30 ft apart screened from approximately 10 to 30 ft bgs and five additional monitoring wells (MW-16, MW-17, MW-18, MW-19 and MW-20) to supplement the existing well network, as shown on **Figure 8**. Solutions-IES is planning on installing two 10-ft screens at 10 to 20 and 20 to 30 ft bgs in each injection well and a 10-ft screen from 25 to 35 ft bgs in each monitoring well to monitor the 20 ft injection interval. Once the well installation is complete, a baseline sampling event will take place. The following 16 wells will be part of the overall performance monitoring network:

- Shallow monitoring wells: MW-1, MW-2, MW-3, MW-4, MW-5, MW-8, MW-11, MW-9, MW-13, MW-16, MW-17, MW-18, MW-19 and MW-20
- Deep monitoring wells: MW-14, MW-15.

The baseline sampling will include the following parameters:

| **Tentative Baseline Sampling and Analysis Plan (number of wells monitored)** | |
|---|---|
| **Field Parameters** | |
| Water Level | 16 |
| pH, DO, ORP, Specific Conductance, Temperature, Turbidity | 16 |
| Laboratory Parameters | |
| Volatile Organic Compounds (VOCs) | 16 |
| Nitrate-N; sulfate | 16 |
| $Fe^{+3}/Fe^{+2}$; Mg (total) | 16 |
| TOC | 16 |
| Alkalinity | 16 |
| Methane, Ethane, Ethene (MEE) | 16 |
| Volatile Fatty Acids (VFAs) | 5[a] |
| MBTs (*Dehalobacter sp.*, *Dehalococcoides sp.*, TCE-reductase, BAV-1 VC-reductase, and VC-reductase) | 5 |

a. MW-2, MW-4, MW-16, MW-18, MW-19

Water levels will be measured using an electronic water level indicator to collect water level data that will be used to interpret groundwater flow direction. Each well will be purged using a peristaltic pump with new polyethylene tubing used at each location. Purging will continue at a low flow rate until the field parameters of pH (± 0.1 standard unit), specific conductivity (± 5%), and turbidity (< 10 NTUs) stabilize. Measurements of temperature, DO, and ORP will also be recorded. Samples will be collected into laboratory-supplied 40 ml glass volatile organic analysis (VOA) vials for VOC analysis. In addition to VOCs, natural attenuation parameters will be collected to monitor the aquifer biogeochemical conditions. The samples will be stored on ice and shipped to a certified environmental laboratory.

Solutions-IES would then inject approximately 60,480 pounds of the extended time-released emulsified oil substrate, diluted at a ratio of 5:1 with potable water. Due to the low pH in much of the injection area, Solutions-IES will also inject approximately 8,400 pounds of a colloidal buffer such as CoBupH-Mg™ to

increase the pH to more favorable conditions for bacteria. The colloidal buffer is also designed for greater longevity in the aquifer compared to soluble buffers such as bicarbonate. The substrate and buffer will be chased from the injection well into the aquifer using additional potable water sufficient to achieve a design radius of influence of 15 ft. Approximately 6,000 to 8,000 gallons of substrate/water will be injected into each well. An injection rate of 1 gpm into the sand/gravel layer is anticipated based on PDI information. The injection process is anticipated to require up to 18 days to complete considering that approximately half of the injection wells (30) will be injected simultaneously in the first 9 days and remaining half in the last 9 days. Approximately 113 liters of bioaugmentation culture will also be injected once the aquifer pH has increased and a reducing environment has been established. Bioaugmentation will require up to two additional days to complete.

More details, as needed, will be discussed in the Pre-Construction Report to be submitted once the UIC Permit has been obtained. A project schedule is provided in **Appendix B**.

## 6.3 PERFORMANCE MONITORING PLAN

The performance monitoring network includes wells located within the plume and at the lateral and vertical boundaries of the plume. The same 16 wells sampled during the baseline event will comprise the long term performance monitoring network. As shown in **Figure 8**, these include:

- Shallow monitoring wells: MW-1, MW-2, MW-3, MW-4, MW-5, MW-8, MW-11, MW-9, MW-13, MW-16, MW-17, MW-18, MW-19 and MW-20
- Deep monitoring wells: MW-14, MW-15.

Quarterly monitoring events will be scheduled during Year 0 approximately 3 month, 6 month, 9 month and 12-months post-injection. Nine wells will be sampled during the first three post-injection monitoring events. Five will be from within the immediate treatment area including MW-2, MW-4, MW-8, MW-16 and MW-18. Because MNA is the downgradient remedy and there are little historical data to review, the first three of these events will also include four wells located outside the immediate treatment area including MW-7, MW-9, MW-19 and MW-20. The samples will be collected for field parameters and the laboratory analyses shown in the following table.

| Year 0 Post-Injection Performance Monitoring (number of wells monitored) | | | | |
|---|---|---|---|---|
| **Analysis** | **3-Month** | **6-Month** | **9-Month** | **First Annual** |
| **Field Parameters** | | | | |
| Water Levels | 9[a] | 9 | 9 | 16 |
| DO, ORP, pH, Spec. Cond., Temperature | 9 | 9 | 9 | 16 |
| **Laboratory Parameters** | | | | |
| VOCs | 9 | 9 | 9 | 16 |
| Nitrate-N; sulfate | 9 | 9 | 9 | 16 |
| $Fe^{+3}/Fe^{+2}$; Mg (total) | 9 | 9 | 9 | 16 |
| TOC | 9 | 9 | 9 | 16 |
| Alkalinity | 9 | 9 | 9 | 16 |
| MEE | 9 | 9 | 9 | 16 |
| VFA | 5[b] | 5 | 5 | 5 |
| MBTs | 0 | 5 | 0 | 5 |

a. MW-2, MW-4, MW-7, MW-8, MW-9, MW-16, MW-18, MW-19, MW-20
b. MW-2, MW-4, MW-16, MW-18, MW-19

The sampling will be performed using low-flow sampling methodology as described for the baseline event above and will ultimately provide information about injection performance and MNA. Thereafter, sampling will be reduced to semi-annually at all 16 wells during Years 1 through 5, and then annually until Year 15. The sampling and analysis plan for these years will be similar to that shown for the baseline. The monitoring component is assumed for 15 years for costing purposes only.

## 6.4 REPORTING

Reporting will follow the requirements of the REC Program. A Construction Completion Report will follow after the injection and the 3-month post-injection performance monitoring event are completed and will serve as the quarterly status update. A semi-annual report will be prepared in Year 0 after the 6-month sampling event. A quarterly status update will be prepared after the 9-month event and the first annual groundwater monitoring report will be prepared after the 12-month event. Thereafter, groundwater monitoring reports will be prepared after each semi-annual or annual monitoring event is completed. After Year 0, quarterly status reports will no longer be submitted. The groundwater monitoring reports will document monitoring activities and remedy performance as they occur. Each report (except quarterly status updates) will include the following:

- Groundwater elevation figure(s) and table(s);
- Graphs of PCE, TCE and 1,1-DCE concentrations versus time in selected wells;
- Figure depicting the lateral extent of total COCs;
- Other figures or tables that may be useful to describe the performance of the remedy.
- At the end of Year 4, statistical evaluation of the data trends (e.g., Mann-Kendall or Mann-Whitney) from the complete data set from Years 0 through 4 will be evaluated and included with the second semi-annual report for Year 4. Similar statistical evaluations will be performed again after Year 7 and Year 10 sampling events and reported in the annual reports for those years.
- An evaluation of the effectiveness of the remedy in the treated areas (e.g., concentration and mass reductions and chlorine number evaluations of biodegradation) and MNA downgradient.

## 6.5 CONTINGENCY PLAN

It should be noted that the estimated cost to implement ERD using the extended release emulsified oil product already includes a second injection of substrate 10 years after the initial injections. This is based on the manufacturer's estimates of product life and performance. In the annual report proposed for Year 7, an in-depth evaluation of the effectiveness of the remedy will be prepared. The evaluation will discuss progress toward reaching the remedial objectives via biodegradation, successful long term establishment of a dechlorinating microbial community, continued stability of the re-engineered aquifer to support biodegradation, and the residual concentrations of bioavailable substrate. Conditions that could affect longevity of the extended release components of EOS XR could include microbial consumption and solubilization/breakdown followed by migration from the target treatment zones. This could result in reduced effectiveness. Should the data indicate a decline in performance as a result of contact between remaining substrate, microbial communities, and geochemical conditions, as a contingency, Eaton will consider options ranging from continued monitoring to improving the current approach via earlier replenishment of substrate and bioaugmentation, if needed. If, after 10 Years of monitoring, no improvement is seen, Eaton may explore other technologies to help reach the project goals.

## 6.6 COMMUNITY HEALTH AND SAFETY PLAN

The health and safety of the nearby residents and businesses will not be adversely affected by activities related to the remedial action. The Community H&S Plan is provided in **Appendix C**.

## 6.7 DECONTAMINATION PROCEDURES

Equipment used for sampling activities will arrive on site in clean condition. With the exception of certified laboratory-cleaned equipment, sampling, testing, or measuring equipment that comes in contact with

potentially sampled medium will be decontaminated prior to use, unless it arrives prepackaged by a manufacturer. Equipment will also be decontaminated between sampling locations. If disposable sampling equipment (clean prepackaged materials) is used, it will not be decontaminated before use and will be disposed of properly after one use. Disposable equipment will not be used at more than one sampling location.

If decontamination activities are to take place in the field, a decontamination area will be set up preferably upwind from the sampling area(s) prior to initiating field activities. For decontamination of hand-held sampling equipment, plastic sheeting will be spread on the ground and the decontamination tubs and/or buckets and rinse bottles will be placed in order on top of the plastic.

The following steps for decontamination will be applied to all equipment that will come in contact with the sampling medium. Physically remove as much of the visible material as possible from the sampling equipment after use and before submersing it in decontamination fluids.

- Scrub with nonphosphate detergent (e.g., Liquinox)/potable water solution,
- Rinse with potable water,
- Rinse with deionized water,
- Air dry, as conditions allow, and
- Wrap in aluminum foil or place in a clean resealable plastic bag.

Solvents and/or nitric acid should never be used to decontaminate any electrical or electronic instrumentation, unless specified by the manufacturer. Decontamination fluids should be containerized with other investigation-derived waste (IDW) from the site such as purge water.

## 6.8 INVESTIGATION-DERIVED WASTE

Soil and groundwater IDW generated during well installation, substrate injection and performance monitoring activities will be temporarily containerized in DOT-approved 55-gallon metal drums or roll-off boxes. The drums/boxes will be temporarily stored at an approved location at the site. At least one composite soil sample will be collected from drums containing soil IDW. These samples will be characterized according to state requirements and subsequently managed according to state regulation based on the characterization results. Solutions-IES will make arrangements for disposal by a certified waste handler. Eaton will be notified if any IDW is deemed to be hazardous. Based upon previous IDW produced

at the site, it is anticipated that the soil will be characterized as non-hazardous, but the water may be characterized as hazardous.

## 7.0 REFERENCES

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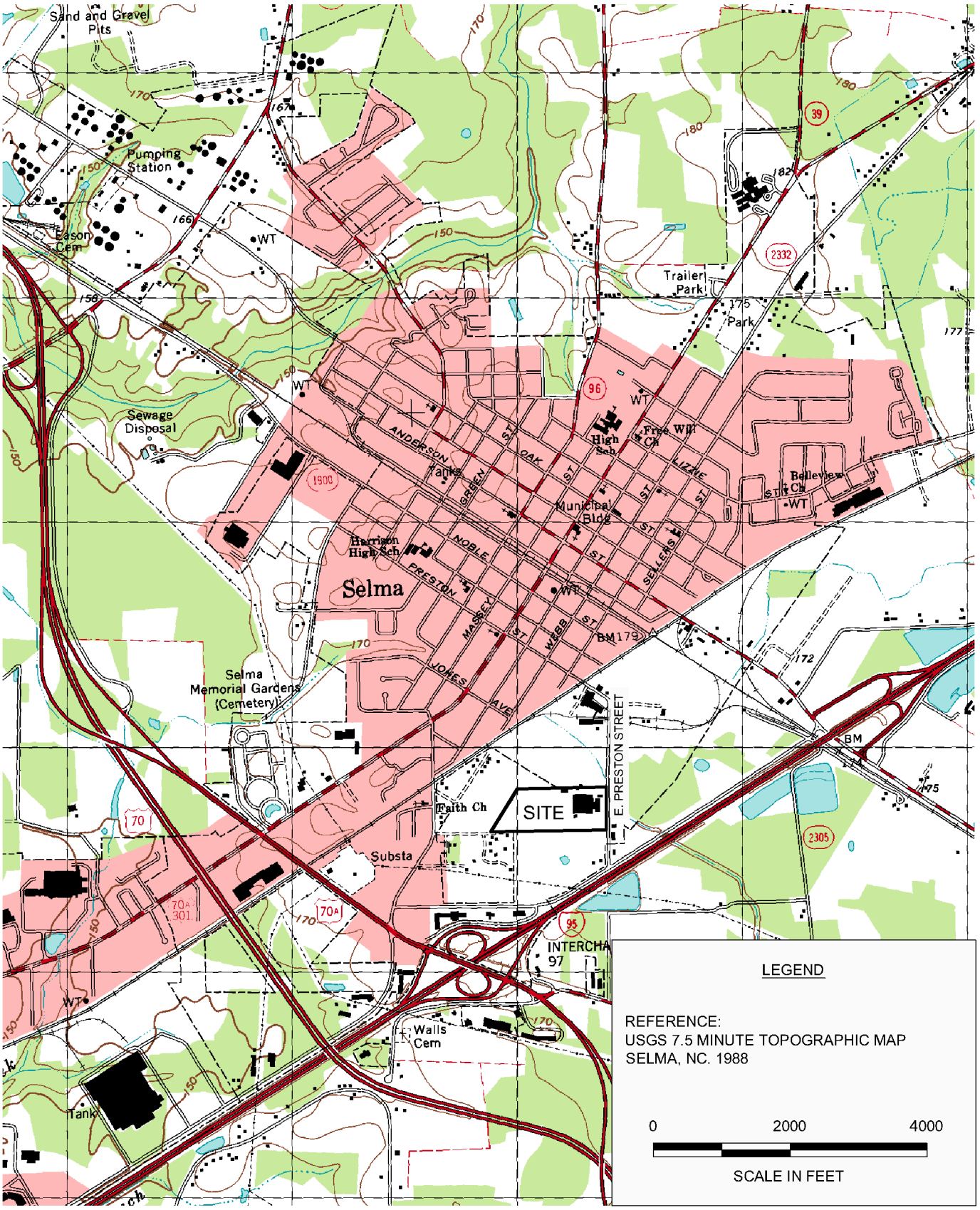
Solutions-IES, 2012. Phase II Remedial Investigation Report, Former Eaton Corporation Facility, 1100 East Preston Street, Selma, Johnston County, North Carolina, February 8.

# FIGURES




LEGEND

REFERENCE:
USGS 7.5 MINUTE TOPOGRAPHIC MAP
SELMA, NC. 1988

0 2000 4000

SCALE IN FEET

PROJECT NUMBER 2013.0014.EATON

DRAFTER KTS

CHECKED BY MTL

PROJECT MANAGER JLO

DATE 5/6/2013

FILE Eaton Selma GW RAP.dwg

Solutions-IES
Industrial & Environmental Services
1101 NOWELL ROAD
RALEIGH, NORTH CAROLINA 27607
TEL.: (919) 873-1060 FAX.: (919) 873-1074

SITE LOCATION MAP
FORMER EATON FACILITY
1100 EAST PRESTON STREET
SELMA, JOHNSTON COUNTY, NC

FIGURE:
1

J:\Project Files\Eaton Corporation\Eaton Selma\CAD\Current Drawings\Remedial Action Plan\Eaton Selma GW RAP.dwg

PROJECT NUMBER 2013.0014.EATON
DRAFTER KTS
CHECKED BY MTL
PROJECT MANAGER JLO
DATE 5/6/2013
FILE Eaton Selma GW RAP.dwg

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NOTES:
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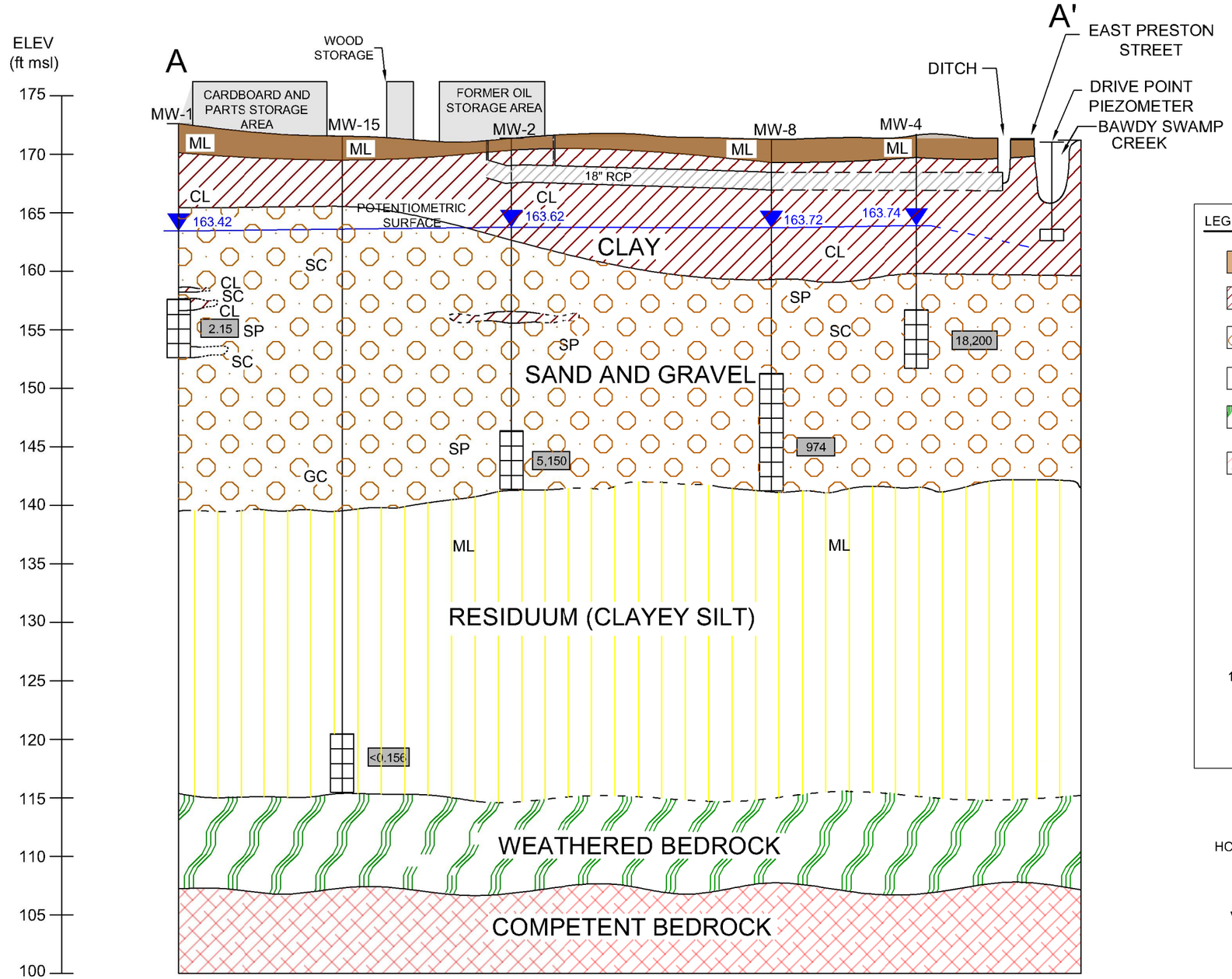
FORMER EATON FACILITY
1100 EAST PRESTON STREET
SELMA, JOHNSTON COUNTY, NC

SITE MAP WITH GEOLOGIC CROSS SECTION LOCATION

FIGURE: 2

J:\Project Files\Eaton Corporation\Eaton Selma\CAD\Current Drawings\Remedial Action Plan\Eaton Selma GW RAP..dwg




LEGEND

| | |
|---|---|
| | TOPSOIL, SILT |
| | SILTY CLAY WITH SAND STRINGERS |
| | SAND, VARIES BETWEEN CLAYEY AND SILTY, SOME LARGE GRAVEL LENSES |
| | RESIDUUM, CLAYEY SILT, BECOMES HARDER WITH DEPTH |
| | WEATHERED BEDROCK |
| | COMPETENT BEDROCK - HARD, SLIGHTLY WEATHERED TO WEATHERED GRAY-GREEN METAVOLCANIC ROCK |
| CL | CLAY |
| SC | CLAYEY SAND |
| SP | GRAVELLY SAND |
| ML | SILT |
| RCP | REINFORCED CONCRETE PIPE |
| 163.62 | STATIC WATER LEVEL JUNE 27, 2011 |
| 18,200 | MONITOR WELL SCREENED INTERVAL PCE CONCENTRATION (µg/L) |

HORIZONTAL SCALE 0 100 200
SCALE IN FEET

VERTICAL SCALE 0 10 20
SCALE IN FEET

PROJECT NUMBER 2013.0014.EATON
DRAFTER KTS
CHECKED BY MTL
PROJECT MANAGER JLO
DATE 5/6/2013
FILE Eaton Selma GW RAP.dwg

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FORMER EATON FACILITY
1100 EAST PRESTON STREET
SELMA, JOHNSTON COUNTY, NC

GEOLOGIC CROSS SECTION A - A'

FIGURE: 3

PROJECT NUMBER 2013.0014.EATON
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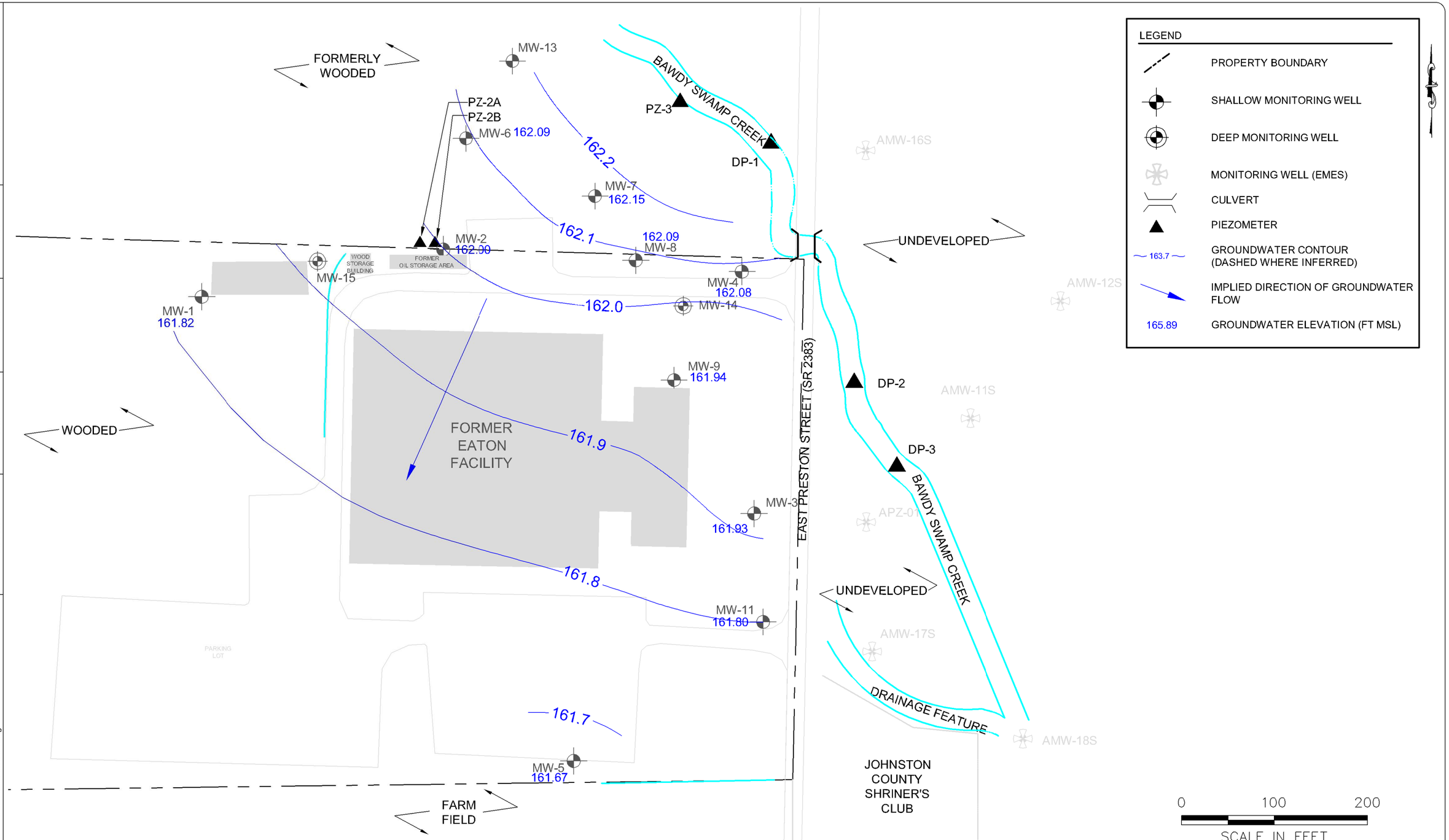
PROJECT MANAGER JLO
DATE 5/6/2013
FILE Eaton Selma GW RAP.dwg





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3) AMW WELLS NOT USED TO GENERATE GROUNDWATER ELEVATION MAP.

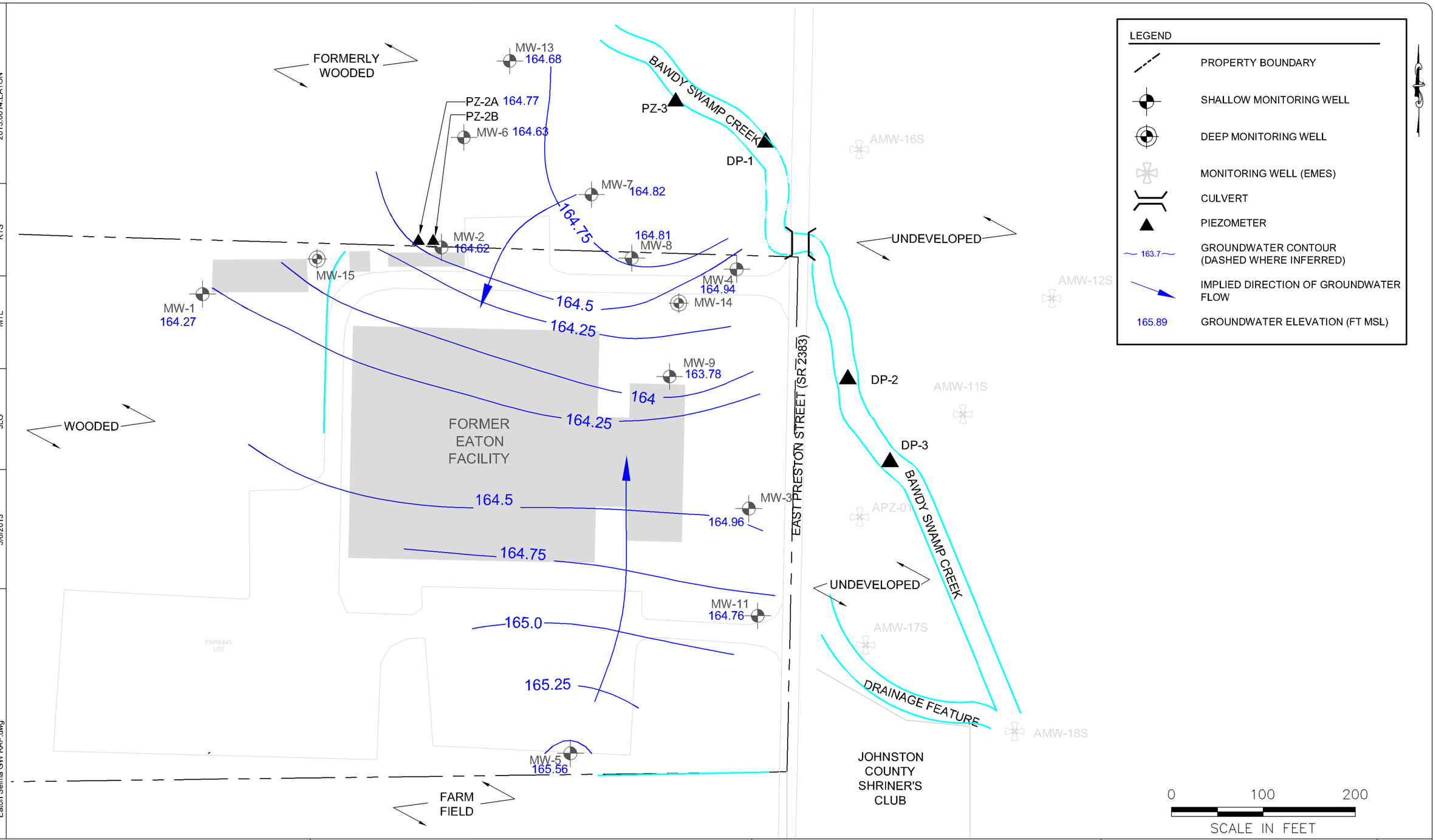
FORMER EATON FACILITY
1100 EAST PRESTON STREET
SELMA, JOHNSTON COUNTY, NC

SHALLOW GROUNDWATER ELEVATION MAP
OCTOBER 2012

FIGURE: 4

J:\Project Files\Eaton Corporation\Eaton Selma\CAD\Current Drawings\Remedial Action Plan\Eaton Selma GW RAP..dwg

PROJECT NUMBER 2013.0014.EATON
DRAFTER KTS
CHECKED BY MTL
PROJECT MANAGER JLO
DATE 5/6/2013
FILE Eaton Selma GW RAP.dwg





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3) AMW WELLS NOT USED TO GENERATE GROUNDWATER ELEVATION MAP.

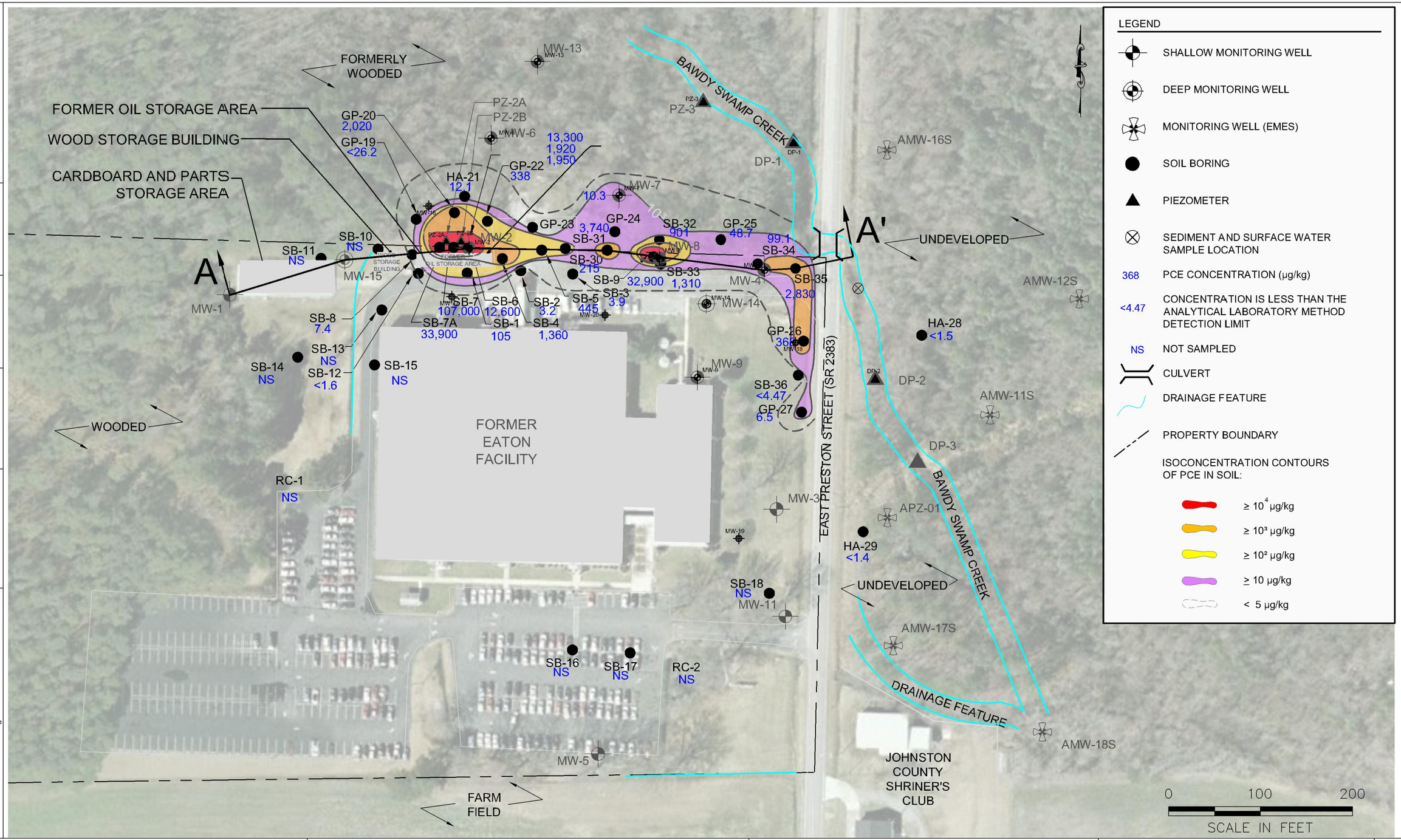
FORMER EATON FACILITY
1100 EAST PRESTON STREET
SELMA, JOHNSTON COUNTY, NC

SHALLOW GROUNDWATER ELEVATION MAP
JANUARY 2013

FIGURE: 5

J:\Project Files\Eaton Corporation\Eaton Selma\CAD\Current Drawings\Remedial Action Plan\Eaton Selma GW RAP..dwg

PROJECT NUMBER 2013.0014.EATON
DRAFTER SAM
CHECKED BY MTL
PROJECT MANAGER JLO
DATE 5/6/2013
FILE Eaton Selma GW RAP.dwg





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FORMER EATON FACILITY
1100 EAST PRESTON STREET
SELMA, JOHNSTON COUNTY, NC

ESTIMATED EXTENT OF PCE IN SOIL

FIGURE: 6

J:\Project Files\Eaton Corporation\Eaton Selma\CAD\Current Drawings\Remedial Action Plan\Eaton Selman GW RAP².dwg

PROJECT NUMBER 2013.0014.EATON

DRAFTER SAM

CHECKED BY MTL

PROJECT MANAGER JLO

DATE 5/6/2013

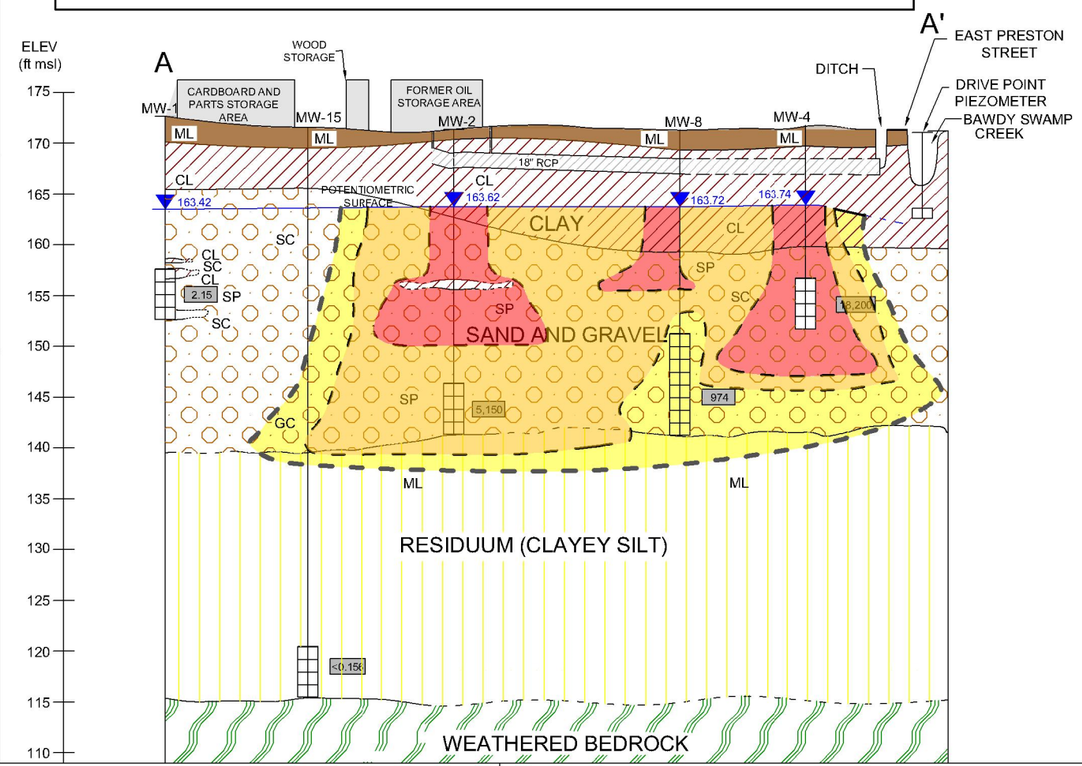
FILE Eaton Selma GW RAP.dwg

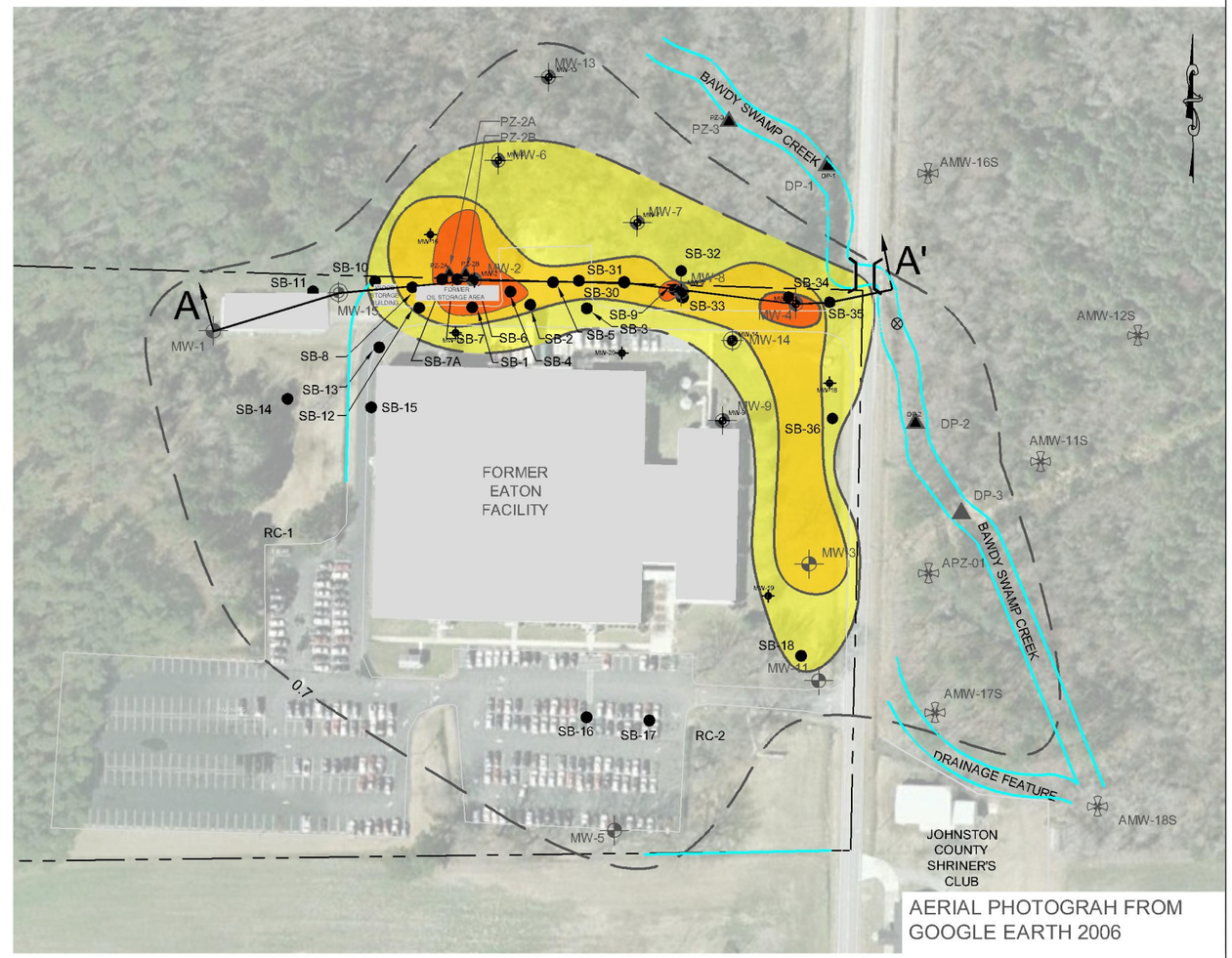
## LEGEND

- PROPERTY BOUNDARY
- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- TEMPORARY MONITORING WELL
- MONITORING WELL (EMES)
- PIEZOMETER
- SEDIMENT AND SURFACE WATER SAMPLE LOCATION
- MAA GROUNDWATER SAMPLE (2008)
- SOIL BORING
- 2.15 PCE CONCENTRATION (µg/L)
- STATIC WATER LEVEL JUNE 27, 2011
- 1.53 MONITOR WELL SCREENED INTERVAL AND PCE CONCENTRATION (µg/L)
- DRAINAGE FEATURE
- CULVERT

ISOCONCENTRATION CONTOURS OF PCE IN GROUNDWATER:

- ≥ $10^4$ µg/L
- ≥ $10^3$ µg/L
- ≥ $10^2$ µg/L
- ≥ 0.7 µg/L




AERIAL PHOTOGRAH FROM GOOGLE EARTH 2006

VERTICAL SCALE

0 15 30

SCALE IN FEET

HORIZONTAL SCALE

0 150 300

SCALE IN FEET

0 150 300

SCALE IN FEET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FORMER EATON FACILITY
1100 EAST PRESTON STREET
SELMA, JOHNSTON COUNTY, NC

ESTIMATED EXTENT OF PCE IN GROUNDWATER

FIGURE: 7

J:\Project Files\Eaton Corporation\Eaton Selma\CAD\Current Drawings\Remedial Action Plan\Eaton Selma GW RAP..dwg

PROJECT NUMBER 2013.0014.EATON
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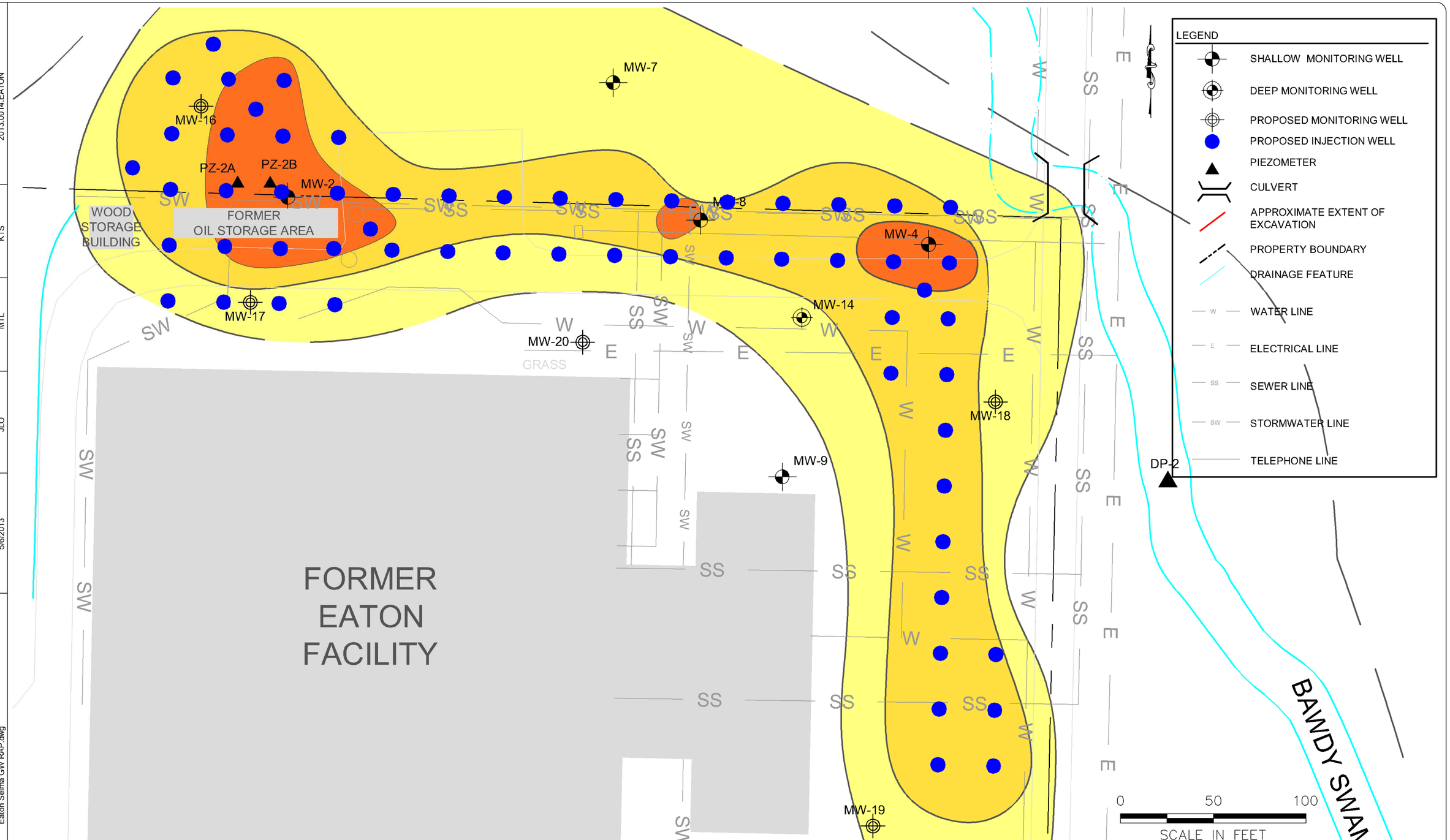
PROJECT MANAGER JLO
DATE 5/6/2013
FILE Eaton Selma GW RAP.dwg





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FORMER EATON FACILITY
1100 EAST PRESTON STREET
SELMA, JOHNSTON COUNTY, NC

PROPOSED INJECTION WELL LOCATIONS

FIGURE: 8

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# TABLES

**TABLE 1**
**SUMMARY OF GROUNDWATER ELEVATION DATA**
**FORMER EATON CORPORATION**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLINA**

| Monitoring Well or Piezometer ID | Top of PVC (ft msl)[1] | Screened Interval (ft bgs) | Date | Depth-To-Water (ft) | Groundwater Elevation (ft msl) |
|---|---|---|---|---|---|
| **Shallow Monitoring Wells** | | | | | |
| MW-1 | 172.00 | 15 - 20 | 6/18/2008 | 6.61 | 165.39 |
| | | | 7/16/2008 | 6.60 | 165.40 |
| | | | 4/8/2009 | 1.68 | 170.32 |
| | | | 4/22/2009 | 1.38 | 170.62 |
| | | | 7/28/2010 | 8.53 | 163.47 |
| | | | 6/27/2011 | 8.58 | 163.42 |
| | | | 4/27/2012 | 5.65 | 166.35 |
| | | | 10/30/2012 | 10.18 | 161.82 |
| | | | 1/31/2013 | 7.73 | 164.27 |
| MW-2 | 171.21 | 25 - 30 | 6/18/2008 | 5.68 | 165.53 |
| | | | 7/16/2008 | 5.65 | 165.56 |
| | | | 4/8/2009 | 0.98 | 170.23 |
| | | | 4/22/2009 | 1.67 | 169.54 |
| | | | 7/28/2010 | 7.45 | 163.76 |
| | | | 6/27/2011 | 7.59 | 163.62 |
| | | | 4/27/2012 | 4.60 | 166.61 |
| | | | 10/30/2012 | 9.21 | 162.00 |
| | | | 1/31/2013 | 6.59 | 164.62 |
| MW-3 | 171.13 | 15 - 20 | 6/18/2008 | 5.14 | 165.99 |
| | | | 7/16/2008 | 4.91 | 166.22 |
| | | | 4/8/2009 | 1.01 | 170.12 |
| | | | 4/22/2009 | 1.58 | 169.55 |
| | | | 7/28/2010 | 7.15 | 163.98 |
| | | | 6/27/2011 | 7.43 | 163.70 |
| | | | 4/27/2012 | 4.43 | 166.70 |
| | | | 10/30/2012 | 9.20 | 161.93 |
| | | | 1/31/2013 | 6.17 | 164.96 |
| MW-4 | 171.56 | 15 - 20 | 6/18/2008 | 5.84 | 165.72 |
| | | | 7/16/2008 | 5.88 | 165.68 |
| | | | 4/8/2009 | 1.31 | 170.25 |
| | | | 4/22/2009 | 2.02 | 169.54 |
| | | | 7/28/2010 | 7.66 | 163.90 |
| | | | 6/27/2011 | 7.82 | 163.74 |
| | | | 4/27/2012 | 4.78 | 166.78 |
| | | | 10/30/2012 | 9.48 | 162.08 |
| | | | 1/31/2013 | 6.62 | 164.94 |
| MW-5 | 170.42 | 15 - 20 | 6/18/2008 | 4.47 | 165.95 |
| | | | 7/16/2008 | 4.02 | 166.40 |
| | | | 4/8/2009 | 0.4 | 170.02 |
| | | | 4/22/2009 | 1.06 | 169.36 |
| | | | 7/28/2010 | 6.57 | 163.85 |
| | | | 6/27/2011 | 6.93 | 163.49 |
| | | | 4/27/2012 | 4.52 | 165.90 |
| | | | 10/30/2012 | 8.75 | 161.67 |
| | | | 1/31/2013 | 4.86 | 165.56 |

**TABLE 1**
**SUMMARY OF GROUNDWATER ELEVATION DATA**
**FORMER EATON CORPORATION**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLINA**

| Monitoring Well or Piezometer ID | Top of PVC (ft msl)[1] | Screened Interval (ft bgs) | Date | Depth-To-Water (ft) | Groundwater Elevation (ft msl) |
|---|---|---|---|---|---|
| MW-6 | 173.88 | 20-30 | 7/28/2010 | 10.13 | 163.75 |
| | | | 6/27/2011 | 10.26 | 163.62 |
| | | | 4/27/2012 | 7.34 | 166.54 |
| | | | 10/30/2012 | 11.85 | 162.03 |
| | | | 1/31/2013 | 9.25 | 164.63 |
| MW-7 | 174.68 | 20-30 | 7/28/2010 | 10.78 | 163.90 |
| | | | 6/27/2011 | 10.94 | 163.74 |
| | | | 4/27/2012 | 8.00 | 166.68 |
| | | | 10/30/2012 | 12.53 | 162.15 |
| | | | 1/31/2013 | 9.86 | 164.82 |
| MW-8 | 171.08 | 20-30 | 7/28/2010 | 7.23 | 163.85 |
| | | | 6/27/2011 | 7.36 | 163.72 |
| | | | 4/27/2012 | 4.34 | 166.74 |
| | | | 10/30/2012 | 8.99 | 162.09 |
| | | | 1/31/2013 | 6.27 | 164.81 |
| MW-9 | 172.66 | 28-38 | 7/28/2010 | 9.05 | 163.61 |
| | | | 6/27/2011 | 9.03 | 163.63 |
| | | | 4/27/2012 | -- | -- |
| | | | 10/30/2012 | 10.72 | 161.94 |
| | | | 1/31/2013 | 8.88 | 163.78 |
| MW-11 | 170.25 | 25-35 | 7/28/2010 | 6.35 | 163.90 |
| | | | 6/27/2011 | 6.62 | 163.63 |
| | | | 4/27/2012 | 3.70 | 166.55 |
| | | | 10/30/2012 | 8.45 | 161.80 |
| | | | 1/31/2013 | 5.49 | 164.76 |
| MW-13 | 173.94 | 21-31 | 6/27/2011 | 10.32 | 163.62 |
| | | | 4/27/2012 | 7.40 | 166.54 |
| | | | 1/31/2013 | 9.26 | 164.68 |
| **EMES Wells (Shallow Zone)[2]** | | | | | |
| AMW-11S | 175.63 | 11.9-21.9 | 6/27/2011 | 11.72 | 163.91 |
| AMW-12S | 175.25 | 13.1-23.1 | 6/27/2011 | 11.14 | 164.11 |
| AMW-16S | 174.62 | 11.45-16.45 | 6/27/2011 | 10.84 | 163.78 |
| AMW-17S | 176.08 | 14.1-24.1 | 6/27/2011 | 11.65 | 164.43 |
| AMW-18S | 175.58 | 14.1-24.1 | 6/27/2011 | 11.90 | 163.68 |
| APZ-01 | 174.98 | 12.0-22.0 | 6/27/2011 | 11.15 | 163.83 |
| **Deep Monitoring Wells** | | | | | |
| MW-14 | 171.45 | 47-57 | 6/27/2011 | 7.53 | 163.92 |
| | | | 4/27/2012 | 4.56 | 170.42 |
| | | | 10/30/2012 | 9.22 | 162.23 |
| | | | 1/31/2013 | 6.39 | 165.06 |
| MW-15 | 171.49 | 46-56 | 6/27/2011 | 8.00 | 163.49 |
| | | | 4/27/2012 | 5.19 | 166.30 |
| | | | 10/30/2012 | 9.47 | 162.02 |
| | | | 1/31/2013 | 7.16 | 164.33 |

**TABLE 1**
**SUMMARY OF GROUNDWATER ELEVATION DATA**
**FORMER EATON CORPORATION**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLINA**

| Monitoring Well or Piezometer ID | Top of PVC (ft msl)[1] | Screened Interval (ft bgs) | Date | Depth-To-Water (ft) | Groundwater Elevation (ft msl) |
|---|---|---|---|---|---|
| **Piezometers** | | | | | |
| DP-1 | 171.01 | 4-5 | 7/28/2010 | DRY | <162.61 |
| | | | 6/27/2011 | DRY | <162.61 |
| | | | 4/27/2012 | 2.95 | 168.06 |
| | | | 10/30/2012 | 2.95 | 168.06 |
| | | | 1/31/2013 | 4.53 | 166.48 |
| DP-2 | 170.59 | 4-5 | 7/28/2010 | DRY | <162.34 |
| | | | 6/27/2011 | DRY | <162.34 |
| | | | 4/27/2012 | 2.93 | 167.66 |
| | | | 10/30/2012 | 2.82 | 167.77 |
| | | | 1/31/2013 | 2.93 | 167.66 |
| DP-3 | 170.51 | 4-5 | 7/28/2010 | DRY | <162.21 |
| | | | 6/27/2011 | DRY | <162.21 |
| | | | 4/27/2012 | 2.50 | 168.01 |
| | | | 10/30/2012 | 2.94 | 167.57 |
| | | | 1/31/2013 | 3.56 | 166.95 |
| PZ-2A | 172.84 | 13.5-14.5 | 4/22/2009 | 2.69 | 170.15 |
| | | | 6/27/2011 | 9.14 | 163.70 |
| | | | 10/30/2012 | 10.62 | 162.22 |
| | | | 1/31/2013 | 8.07 | 164.77 |
| PZ-2B | 172.81 | 5.5-6.5 | 4/22/2009 | 4.75 | 168.06 |
| | | | 6/27/2011 | DRY | DRY |
| | | | 10/30/2012 | --[1] | --[1] |
| PZ-3 | 170.01 | 7.5-8.5 | 4/22/2009 | 0.64 | 169.37 |
| | | | 6/27/2011 | 1.0 | -1.00 |
| | | | 10/30/2012 | --[1] | --[1] |
| DITCH | [3] | -- | 4/22/2009 | 1.31 | -1.31 |

Notes:
[1] = Depth to water could not be determined due to size of water level indicator
ft msl = feet mean sea level (NAVD 1988)
ft bgs = feet below ground surface
Piezometer elevations were measured from nearby monitoring wells and are approximate.
1. All wells were surveyed by KCI Associates.
2. Ditch water elevation determined at time of reading from top of PVC of PZ-3.
3. The ExxonMobil Environmental Services Company (EMES) monitoring wells are part of the Gurley Pesticide Site and do not belong to Eaton Corporation
-- Well not located

**TABLE 2**
**SUMMARY OF GROUNDWATER REMEDIATION GOALS**
**FORMER EATON CORPORATION**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLINA**

| **Primary Contaminants of Concern** | **NC 2L Standard** |
|---|---|
| Tetrachloroethene (PCE) | 0.7 |
| Trichloroethene (TCE) | 3 |
| 1,1-Dichloroethene (1,1-DCE) | 7 |
| **Secondary Contaminants of Concern** | |
| 1,1,1-Trichloroethane (TCA) | 200 |
| 1,1,2-Trichloroethane (1,1,2-TCA) | NE |
| 1,1-Dichloroethane (1,1-DCA) | 6 |
| 1,2-Dichloroethane (1,2-DCA) | 0.4 |
| Carbon tetrachloride (CT) | 0.3 |
| Benzene | 1 |
| 1,2-Dichlorobenzene (1,2-DCB) | 20 |
| Dibromochloromethane | 0.4 |
| **CVOC Degradation Daughter Products** | |
| *cis* -1,2-Dichloroethene (*c* DCE) | 70 |
| Vinyl Chloride (VC) | 0.03 |

**TABLE 3**
**SUMMARY OF ANALYTICAL LABORATORY DATA FOR VOCS IN PERMANENT MONITORING WELLS**
**FORMER EATON CORPORATION**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLINA**

| Monitoring Well | Date Sampled | VOCs by EPA Method 8260B | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Chlorinated VOCs | | | | | | | | | | | Petroleum VOCs | | THMs |
| | | Carbon tetrachloride | 1,1-DCA | 1,2-DCA | 1,1-DCE | cis-1,2-DCE | trans-1,2-DCE | PCE | 1,1,1-TCA | 1,1,2-TCE | TCE | VC | Benzene | 1,2-Dichloro benzene | Dibromo chloromethane |
| NC 2L Standard (µg/L) | | 0.3 | 6 | 0.4 | 7 | 70 | 100 | 0.7 | 200 | NE | 3 | 0.03 | 1 | 20 | 0.4 |
| **Shallow Monitoring Wells** | | | | | | | | | | | | | | | |
| MW-1 | 6/18/2008 | <0.25 | <0.32 | <0.12 | <0.56 | <0.19 | <0.49 | **1.2** | <0.48 | <0.29 | <0.47 | <0.62 | **2.8** | <0.30 | <0.21 |
| | 7/29/2010 | <1.00 | **4.58** | <1.00 | <1.00 | **7.02** | <1.00 | **2.15** | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 |
| MW-2 | 6/18/2008 | **6.6** | **7.0** | <0.12 | **1,780** | **4.4** | <0.49 | **8,820** | **6.5** | **1.8** | **1,080** | <0.62 | **1.2** | **102** | <0.21 |
| | 4/7/2009 | <2.5 | <3.2 | <1.2 | **910** | **100** | <4.9 | **7,140** | <4.8 | <2.9 | **879** | <6.2 | <2.5 | <3.0 | <2.1 |
| | 7/28/2010 | <320 | <320 | <320 | **838** | <320 | <320 | **5,150** | <320 | <320 | **624** | <320 | <320 | <320 | <320 |
| MW-3 | 6/18/2008 | <0.25 | <0.32 | <0.12 | **13.9** | <0.19 | <0.49 | **573** | **3.1** | < 0.29 | **2.8** | <0.62 | <0.25 | <0.30 | <0.21 |
| | 7/29/2010 | <80.0 | <80.0 | <80.0 | <80.0 | <80.0 | <80.0 | **1,630** | <80.0 | <80.0 | <80.0 | <80.0 | <80.0 | <80.0 | <80.0 |
| MW-4 | 6/18/2008 | <0.25 | **6.3** | <0.12 | **553** | **1.0** | <0.49 | **2,320** | **47.6** | **1.1** | **1,030** | <0.62 | <0.25 | <0.30 | <0.21 |
| | 7/28/2010 | <1,250 | <1,250 | <1,250 | **3,230** | <1,250 | <1,250 | **18,200** | **6,560** | <1,250 | **3,460** | <1,250 | <1,250 | <1,250 | <1,250 |
| | 10/30/2012 | <4.23 | **7.00 J** | <3.48 | **3,140** | <4.48 | <6.18 | **25,800** | **8,940** | <5.40 | **3,380** | <9.65 | <3.90 | **15.0 J** | <12.8 |
| MW-5 | 6/18/2008 | <0.25 | <0.32 | <0.12 | <0.56 | <0.19 | <0.49 | <0.46 | < 0.48 | < 0.29 | < 0.47 | <0.62 | <0.25 | <0.30 | <0.21 |
| | 7/29/2010 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | **1.53** | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 |
| MW-6 | 7/28/2010 | <10.0 | <10.0 | <10.0 | **24.7** | <10.0 | <10.0 | **244** | <10.0 | <10.0 | **14.2** | <10.0 | <10.0 | <10.0 | <10.0 |
| MW-7 | 7/28/2010 | <16.0 | <16.0 | <16.0 | **52.3** | <16.0 | <16.0 | **273** | <16.0 | <16.0 | **29.6** | <16.0 | <16.0 | <16.0 | <16.0 |
| MW-8 | 7/28/2010 | <50.0 | <50.0 | <50.0 | **132** | <50.0 | <50.0 | **974** | **102** | <50.0 | <50.0 | <50.0 | <50.0 | <50.0 | <50.0 |
| | 10/30/2012 | <0.169 | **5.15** | <0.139 | **128** | **1.72** | <0.247 | **874** | **45.9** | <0.216 | **58.2** | <0.386 | <0.156 | **0.430 J** | <0.173 |
| MW-9 | 7/28/2010 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | **3.62** | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 |
| MW-11 | 7/29/2010 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | **2.01** | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 | <1.00 |
| MW-13 | 6/27/2011 | <0.101 | <0.165 | <0.167 | **2.88** | <0.136 | <0.223 | **6.20** | **0.170 J** | <0.126 | **1.60** | <0.124 | <0.113 | <0.137 | <0.134 |
| **Deep Monitoring Wells** | | | | | | | | | | | | | | | |
| MW-14 | 6/27/2011 | <0.101 | <0.165 | <0.167 | <0.212 | <0.136 | <0.223 | **0.230 J** | <0.123 | <0.126 | <0.125 | <0.124 | <0.113 | <0.137 | **0.640 J** |
| MW-15 | 6/27/2011 | <0.101 | <0.165 | <0.167 | <0.212 | <0.136 | <0.223 | **0.440 J** | <0.123 | <0.126 | <0.125 | <0.124 | <0.113 | <0.137 | <0.134 |

**TABLE 3**
**SUMMARY OF ANALYTICAL LABORATORY DATA FOR VOCS IN PERMANENT MONITORING WELLS**
**FORMER EATON CORPORATION**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLINA**

| Monitoring Well | Date Sampled | VOCs by EPA Method 8260B | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Chlorinated VOCs | | | | | | | | | | | Petroleum VOCs | | THMs |
| | | Carbon tetrachloride | 1,1-DCA | 1,2-DCA | 1,1-DCE | cis-1,2-DCE | trans-1,2-DCE | PCE | 1,1,1-TCA | 1,1,2-TCE | TCE | VC | Benzene | 1,2-Dichloro benzene | Dibromo chloromethane |
| NC 2L Standard (µg/L) | | 0.3 | 6 | 0.4 | 7 | 70 | 100 | 0.7 | 200 | NE | 3 | 0.03 | 1 | 20 | 0.4 |
| **EMES Monitoring Wells** | | | | | | | | | | | | | | | |
| APZ-01 | 6/28/2011 | <0.101 | <0.165 | <0.167 | <0.212 | <0.136 | <0.223 | **1.09** | <0.123 | <0.126 | <0.125 | <0.124 | **0.990 J** | <0.137 | <0.134 |
| AMW-11S | 6/27/2011 | <0.101 | <0.165 | <0.167 | <0.212 | <0.136 | <0.223 | **0.210 J** | <0.123 | <0.126 | <0.125 | <0.124 | **0.460 J** | <0.137 | <0.134 |
| AMW-12S | 6/27/2011 | <0.101 | <0.165 | **0.510** | <0.212 | <0.136 | <0.223 | <0.155 | <0.123 | <0.126 | <0.125 | <0.124 | **4.65** | <0.137 | <0.134 |
| AMW-16S | 6/28/2011 | <0.101 | <0.165 | <0.167 | <0.212 | <0.136 | <0.223 | <0.155 | <0.123 | <0.126 | <0.125 | <0.124 | **0.130 J** | <0.137 | <0.134 |
| AMW-17S | 6/28/2011 | <0.101 | <0.165 | <0.167 | **0.880 J** | <0.136 | <0.223 | **4.72** | <0.123 | <0.126 | <0.125 | <0.124 | **0.270 J** | <0.137 | <0.134 |
| AMW-18S | 6/28/2011 | <0.101 | <0.165 | <0.167 | <0.212 | <0.136 | <0.223 | **0.600 J** | <0.123 | <0.126 | <0.125 | <0.124 | <0.113 | <0.137 | <0.134 |

Notes:
All analytical results are reported in µg/L.
THMs = trihalomethanes
NE = not established
< = not detected above the laboratory detection limit shown.
NR = not reported
**Bolded values indicate concentration greater than the laboratory reporting limit.**
Shaded cells are concentrations in excess of the NC 2L Standard or a detection if no NC 2L Standard is estbalished.
J = Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

**TABLE 4**
**SUMMARY OF FIELD PARAMETERS IN PERMANENT MONITORING WELLS**
**FORMER EATON CORPORATION**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLINA**

| Soil Boring ID | Date Sampled | pH (SU) | Specific Conductance (µS/cm) | Temperature (°C) | Turbidity (NTU) | Oxidation-Reduction Potential (mV) | DO (mg/L) |
|---|---|---|---|---|---|---|---|
| **Shallow Monitoring Wells** | | | | | | | |
| MW-1 | 6/18/2008 | 5.0 | 126 | 19.3 | 44 | 81 | NM |
| | 7/29/2010 | 3.8 | 39 | 21.3 | 8 | 79 | 1.0 |
| MW-2 | 6/18/2008 | 5.6 | 177 | 23.4 | 32 | 46 | NM |
| | 4/7/2012 | 6.4 | 139 | 16.5 | 31 | NM | NM |
| | 7/28/2010 | 6.0 | 94 | 29.2 | 7 | 61 | 0.3 |
| MW-3 | 6/18/2008 | 3.6 | 1,287 | 19.5 | 11 | 205 | NM |
| | 7/29/2010 | 3.2 | 4,506 | 20.8 | 4 | 192 | 0.9 |
| MW-4 | 6/18/2008 | 3.9 | 1,201 | 19.4 | 20 | 168 | NM |
| | 7/28/2010 | 3.5 | 2,881 | 19.2 | 19 | 214 | 0.7 |
| | 10/30/2012 | 3.5 | 3,420 | 18.6 | 2 | 413 | 3.0 |
| | 1/31/2013 | 3.6 | 4,297 | 16.7 | 5 | 401 | 0.6 |

**TABLE 4**
**SUMMARY OF FIELD PARAMETERS IN PERMANENT MONITORING WELLS**
**FORMER EATON CORPORATION**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLINA**

| Soil Boring ID | Date Sampled | pH (SU) | Specific Conductance (µS/cm) | Temperature (°C) | Turbidity (NTU) | Oxidation-Reduction Potential (mV) | DO (mg/L) |
|---|---|---|---|---|---|---|---|
| MW-5 | 6/18/2008 | 6.5 | 231 | 19.2 | 11 | 165 | NM |
| | 7/29/2010 | 10.3 | 254 | 21.1 | 171 | 29 | 2.8 |
| MW-6 | 7/28/2010 | 6.1 | 123 | 21.9 | 107 | 79 | 0.2 |
| MW-7 | 7/28/2010 | 6.1 | 179 | 20.5 | 27 | 46 | 0.4 |
| MW-8 | 7/28/2010 | 5.6 | 160 | 20.7 | 20 | 121 | 0.3 |
| | 10/30/2012 | 3.9 | 416 | 17.7 | 14 | 305 | 2.0 |
| | 1/31/2013 | 4.0 | 1,418 | 15.6 | 12 | 352 | 0.6 |
| MW-9 | 7/28/2010 | 5.0 | 72 | 22.5 | 84 | 10 | 0.5 |
| MW-11 | 7/29/2010 | 6.4 | 278 | 23.1 | 84 | 40 | 0.2 |
| MW-13 | 6/27/2011 | 6.0 | 132 | 20.1 | 88 | -94 | 0.4 |
| **Deep Monitoring Wells** | | | | | | | |
| MW-14 | 6/27/2011 | 6.5 | 238 | 23.2 | 240 | 71 | 0.5 |
| MW-15 | 6/27/2011 | 11.0 | 622 | 22.7 | 12 | -68 | 0.2 |
| **EMES Wells** | | | | | | | |
| APZ-01 | 6/28/2011 | 3.3 | 2,469 | 17.7 | 5 | 398 | 0.3 |
| AMW-11S | 6/27/2011 | 3.5 | 1,677 | 18.3 | 3 | 256 | 0.2 |
| AMW-12S | 6/27/2011 | 3.3 | 8,285 | 18.7 | 1 | 290 | 0.5 |
| AMW-16S | 6/28/2011 | 3.8 | 2,185 | 21.2 | 2 | 374 | 0.3 |
| AMW-17S | 6/28/2011 | 3.3 | 2,697 | 21.7 | 2 | 413 | 0.3 |
| AMW-18S | 6/28/2011 | 5.7 | 293 | 19.4 | 21 | 199 | 1.0 |

Notes:
SU = Standard Units
µS/cm = MicroSiemens per centimeter
°C = Degrees Celsius
NTU = Nephelometric Turbidity Units
mV = Millivolts
mg/L = milligrams per liter
NM = not measured
EMES - ExxonMobil Environmental Services Company

**TABLE 5**
**SCREENING OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER**
**FORMER EATON SELMA**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLINA**

| Category | Monitored Natural Attenuation (Stand alone) | Anaerobic Bioremediation in Source Area with MNA | ISCR Source Treatment with MNA | ISCO Source Treatment with MNA |
|---|---|---|---|---|
| **Environmental Protection** | **Protective**<br>- Expected to control CVOC transport and plume expansion; eventually meet remediation goals | **Protective**<br>- Expected to readily reduce CVOC concentrations in Source Areas, control CVOC transport and plume expansion, and meet remediation goals in source and outlying plume | **Protective**<br>- Expected to readily reduce CVOC concentrations in Source Areas, control CVOC transport and plume expansion, and meet remediation goals in source and outlying plume | **Protective**<br>- Expected to readily reduce CVOC concentrations in Source Areas, control CVOC transport and plume expansion, and meet remediation goals in source and outlying plume |
| **Regulatory Compliance** | **In Compliance**<br>- No permits needed<br>- Lines of evidence required to support technology | **In Compliance**<br>- Regulatory standards should be met in groundwater after implementation<br>- UIC permit needed<br>- MW permit may be needed<br>- Accepted technology | **In Compliance**<br>- Regulatory standards should be met in groundwater after implementation<br>- UIC permit needed<br>- MW permit may be needed<br>- Somewhat new technology | **In Compliance**<br>- Regulatory standards should be met in groundwater after implementation<br>- UIC permit needed<br>- MW permit may be needed<br>- Accepted technology |
| **Long-term Effectiveness** | **Slowly Effective**<br>- Expected to meet remediation goals after 30+ years of remediation<br>- Relies on biological and abiotic processes (e.g., dilution, dispersion, advection) to reduce concentrations | **Effective**<br>- Converts groundwater to biologically conducive conditions in Source Areas<br>- Potential to substantially reduce CVOC concentrations and mass in Source Areas in initial 3 to 5 years of remediation<br>- Extended release product could mean one replenishment in ~ year 10..<br>- Outlying plume MNA may still requires longer time, but could be impacted by downgradient spread of organic carbon | **Effective**<br>- Uses chemical reactivity then biological processes to reduce contaminants in Source Areas<br>- Potential to substantially reduce CVOC concentrations and mass in Source Areas in initial 3 to 5 years of remediation<br>- At least one replenishment likely necessary ~ year 5 to address rebound and extend treatment<br>- Outlying plume MNA still requires longer time, but could be impacted by downgradient spread of organic carbon | **Effective**<br>- Uses chemical reactivity to oxidize contaminants in Source Areas<br>- Potential to meet remediation goals in presumed source area after 2 years of remediation<br>- Requires at least 2 more oxidant injections to meet soil oxidant demand and address rebound<br>- Outlying plume MNA still requires longer time, but reactant dissipates before reaching downgradient areas of plume. |

**TABLE 5**
**SCREENING OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER**
**FORMER EATON SELMA**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLINA**

| Category | Monitored Natural Attenuation (Stand alone) | Anaerobic Bioremediation in Source Area with MNA | ISCR Source Treatment with MNA | ISCO Source Treatment with MNA |
|---|---|---|---|---|
| **Reduction of Toxicity, Mobility, and Volume** | - Toxicity: Reduced as CVOCs are slowly degraded<br>- Mobility: Unchanged by process, although dilution and dispersion may serve to reduce concentrations.<br>- Volume: Reduced as CVOCs attenuate | - Toxicity: Reduced as CVOCs are sequestered and then degraded over time.<br>- Mobility: Reduced as CVOCs adsorb to substrate which reduces migration holding CVOCs in contact zone;<br>- Volume: Reduced as CVOCs are degraded | - Toxicity: Reduced as CVOCs are chemically destroyed and then residual CVOCs later biodegraded<br>- Mobility: Reduced as CVOCs adsorb to substrate which reduces migration holding CVOCs in contact zone;<br>- Volume: Reduced as CVOCs are degraded | - Toxicity: Reduced as CVOCs are chemically oxidized<br>- Mobility: Unchanged by process<br>- Volume: Reduced as CVOCs are oxidized |
| **Short-term Effectiveness** | **Ineffective**<br>- Would not achieve NC 2L Standard for PCE over the short-term<br>- Continues to control downgradient migration | **Effective**<br>- Establishes geochemically favorable contact zone<br>- Immediate stimulation of CVOC biodegradation in injection area | **Effective**<br>- Establishes geochemically favorable contact zone<br>- Immediate chemical reduction of CVOCs in injection area<br>- Continued reduction of CVOCs from organic portion of substrate | **Effective**<br>- Immediate chemical oxidation of CVOCs in injection area<br>- Subject to contaminant concentration rebound |
| **Implementability** | **Simple**<br>- No new additional monitoring wells or construction needed<br>- Requires quarterly monitoring and reporting in Year 1, semi-annual monitoring and reporting Years 2 – 5, then annual monitoring and reporting to Year 30 | **Moderate**<br>- Requires construction of injection wells and new monitoring wells<br>- Injection of extended release bioenhancement emulsified oil substrate & bioaugmentation<br>- Monitoring and reporting based on substrate additions, likely a least 15 years | **Moderate**<br>- Requires construction of injection wells and new monitoring wells<br>- Injection of combination chemical reactant /emulsified oil substrate & bioaugmentation<br>- Monitoring and reporting based on substrate additions | **Moderate**<br>- Requires construction of injection wells and new monitoring wells<br>- Addition of $KMnO_4$ oxidant by injection<br>- Monitoring and reporting based on reactant additions<br>- Health and safety handling issues |
| **Cost Range** | **$503,000 - $642,000** | **$918,000 - $1,172,000** | **$1,067,000 - $1,363,000** | **$1,550,000 - $1,981,000** |

**TABLE 5**
**SCREENING OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER**
**FORMER EATON SELMA**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLINA**

| Category | Monitored Natural Attenuation (Stand alone) | Anaerobic Bioremediation in Source Area with MNA | ISCR Source Treatment with MNA | ISCO Source Treatment with MNA |
|---|---|---|---|---|
| **Community Acceptance** | **Acceptable**<br>- Future land use changes may influence acceptance by new property owners | **Acceptable**<br>- Future land use changes may influence acceptance by new property owners | **Acceptable**<br>- Future land use changes may influence acceptance by new property owners | **Acceptable**<br>- Future land use changes may influence acceptance by new property owners |

# APPENDIX A

## NET PRESENT WORTH COST ESTIMATES

**EATON CORPORATION**
**MONITORED NATURAL ATTENUATION NET PRESENT WORTH**
**FORMER EATON SELMA FACILITY**
**1100 EAST PRESTON STREET, SELMA, JOHNSTON COUNTY, NC**

| Year | Capital Costs ($) | Annual Cost ($) | Discount Factor* | Total Cost |
|---|---|---|---|---|
| 0 | $ 78,247.00 | $ - | 1.00000 | $ 78,247.00 |
| 1 | | $ 40,688.44 | 0.93458 | $ 38,026.58 |
| 2 | | $ 42,315.98 | 0.87344 | $ 36,960.41 |
| 3 | | $ 44,008.62 | 0.81630 | $ 35,924.14 |
| 4 | | $ 45,768.96 | 0.76290 | $ 34,916.92 |
| 5 | | $ 47,599.72 | 0.71299 | $ 33,937.94 |
| 6 | | $ 24,751.85 | 0.66634 | $ 16,493.21 |
| 7 | | $ 25,741.93 | 0.62275 | $ 16,030.78 |
| 8 | | $ 26,771.61 | 0.58201 | $ 15,581.32 |
| 9 | | $ 27,842.47 | 0.54393 | $ 15,144.46 |
| 10 | | $ 28,956.17 | 0.50835 | $ 14,719.85 |
| 11 | | $ 30,114.42 | 0.47509 | $ 14,307.14 |
| 12 | | $ 31,318.99 | 0.44401 | $ 13,906.01 |
| 13 | | $ 32,571.75 | 0.41496 | $ 13,516.12 |
| 14 | | $ 33,874.62 | 0.38782 | $ 13,137.16 |
| 15 | | $ 35,229.61 | 0.36245 | $ 12,768.83 |
| 16 | | $ 36,638.79 | 0.33873 | $ 12,410.83 |
| 17 | | $ 38,104.34 | 0.31657 | $ 12,062.86 |
| 18 | | $ 39,628.52 | 0.29586 | $ 11,724.65 |
| 19 | | $ 41,213.66 | 0.27651 | $ 11,395.92 |
| 20 | | $ 42,862.20 | 0.25842 | $ 11,076.41 |
| 21 | | $ 44,576.69 | 0.24151 | $ 10,765.85 |
| 22 | | $ 46,359.76 | 0.22571 | $ 10,464.01 |
| 23 | | $ 48,214.15 | 0.21095 | $ 10,170.62 |
| 24 | | $ 50,142.72 | 0.19715 | $ 9,885.47 |
| 25 | | $ 52,148.42 | 0.18425 | $ 9,608.30 |
| 26 | | $ 54,234.36 | 0.17220 | $ 9,338.91 |
| 27 | | $ 56,403.74 | 0.16093 | $ 9,077.07 |
| 28 | | $ 58,659.88 | 0.15040 | $ 8,822.58 |
| 29 | | $ 61,006.28 | 0.14056 | $ 8,575.21 |
| 30 | | $ 63,446.53 | 0.13137 | $ 8,334.79 |
| **Total** | **$ 78,247.00** | **$ 1,251,195.17** | | **$ 558,000.00** |

| | |
|---|---|
| **Total Dollars =** | **$ 1,330,000.00** |
| **Plus 15% =** | **$ 1,530,000.00** |
| **Minus 10% =** | **$ 1,200,000.00** |

| | |
|---|---|
| **NPW Year 0 =** | **$ 79,000.00** |
| **NPW Years 1 - 5 =** | **$ 180,000.00** |
| **NPW Years 6 - 30 =** | **$ 300,000.00** |
| **NPW Plus 15% =** | **$ 642,000.00** |
| **NPW Minus 10% =** | **$ 503,000.00** |

**EATON CORPORATION**
***IN SITU* BIOREMEDIATION NET PRESENT WORTH**
**FORMER EATON SELMA FACILITY**
**1100 EAST PRESTON STREET, SELMA, JOHNSTON COUNTY, NC**

| Year | Capital Costs ($) | Annual Cost ($) | Discount Factor* | Total Cost |
|---|---|---|---|---|
| 0 | $ 600,247.00 | $ - | 1.00000 | $ 600,247.00 |
| 1 | | $ 40,688.44 | 0.93458 | $ 38,026.58 |
| 2 | | $ 42,315.98 | 0.87344 | $ 36,960.41 |
| 3 | | $ 44,008.62 | 0.81630 | $ 35,924.14 |
| 4 | | $ 45,768.96 | 0.76290 | $ 34,916.92 |
| 5 | | $ 47,599.72 | 0.71299 | $ 33,937.94 |
| 6 | | $ 24,751.85 | 0.66634 | $ 16,493.21 |
| 7 | | $ 25,741.93 | 0.62275 | $ 16,030.78 |
| 8 | | $ 26,771.61 | 0.58201 | $ 15,581.32 |
| 9 | | $ 27,842.47 | 0.54393 | $ 15,144.46 |
| 10 | | $ 28,956.17 | 0.50835 | $ 14,719.85 |
| | $ 182,088.59 | $ - | | $ 92,564.60 |
| 11 | | $ 30,114.42 | 0.47509 | $ 14,307.14 |
| 12 | | $ 31,318.99 | 0.44401 | $ 13,906.01 |
| 13 | | $ 32,571.75 | 0.41496 | $ 13,516.12 |
| 14 | | $ 33,874.62 | 0.38782 | $ 13,137.16 |
| 15 | | $ 35,229.61 | 0.36245 | $ 12,768.83 |
| **Total** | **$ 782,335.59** | **$ 517,555.13** | | **$ 1,019,000.00** |

| | |
|---|---|
| **Total Dollars =** | **$ 1,300,000.00** |
| **Plus 15% =** | **$ 1,495,000.00** |
| **Minus 10% =** | **$ 1,170,000.00** |

| | |
|---|---|
| **Injection and Monitoring (Year 0)=** | **$ 522,000.00** |
| **Reinjection NPW (Year 10) =** | **$ 93,000.00** |
| **MNA NPW Year 0 =** | **$ 79,000.00** |
| **MNA NPW Years 1 - 5 =** | **$ 180,000.00** |
| **MNA NPW Years 6 - 15 =** | **$ 146,000.00** |
| **Plus 15% =** | **$ 1,172,000.00** |
| **Minus 10% =** | **$ 918,000.00** |

**EATON CORPORATION**
***IN SITU* REDUCTION NET PRESENT WORTH**
**FORMER EATON SELMA FACILITY**
**1100 EAST PRESTON STREET, SELMA, JOHNSTON COUNTY, NC**

| Year | Capital Costs ($) | Annual Cost ($) | Discount Factor* | Total Cost ($) |
|---|---|---|---|---|
| 0 | $ 705,247.00 | $ - | 1.00000 | $ 705,247.00 |
| 1 | | $ 40,688.44 | 0.93458 | $ 38,026.58 |
| 2 | | $ 42,315.98 | 0.87344 | $ 36,960.41 |
| 3 | | $ 44,008.62 | 0.81630 | $ 35,924.14 |
| 4 | | $ 45,768.96 | 0.76290 | $ 34,916.92 |
| 5 | | $ 47,599.72 | 0.71299 | $ 33,937.94 |
| | $215,137.28 | $ - | | $ 153,389.91 |
| 6 | | $ 24,751.85 | 0.66634 | $ 16,493.21 |
| 7 | | $ 25,741.93 | 0.62275 | $ 16,030.78 |
| 8 | | $ 26,771.61 | 0.58201 | $ 15,581.32 |
| 9 | | $ 27,842.47 | 0.54393 | $ 15,144.46 |
| 10 | | $ 28,956.17 | 0.50835 | $ 14,719.85 |
| 11 | | $ 30,114.42 | 0.47509 | $ 14,307.14 |
| 12 | | $ 31,318.99 | 0.44401 | $ 13,906.01 |
| 13 | | $ 32,571.75 | 0.41496 | $ 13,516.12 |
| 14 | | $ 33,874.62 | 0.38782 | $ 13,137.16 |
| 15 | | $ 35,229.61 | 0.36245 | $ 12,768.83 |
| **Total** | **$ 920,384.28** | **$ 517,555.13** | | **$ 1,185,000.00** |

| | |
|---|---|
| **Total Dollars =** | **$ 1,440,000.00** |
| **Plus 15% =** | **$ 1,656,000.00** |
| **Minus 10% =** | **$ 1,296,000.00** |

| | |
|---|---|
| **Injection & Monitoring (Year 0) =** | **$ 627,000.00** |
| **Reinjection NPW (Year 5) =** | **$ 154,000.00** |
| **MNA NPW Year 0 =** | **$ 79,000.00** |
| **MNA NPW Years 1 - 5 =** | **$ 180,000.00** |
| **MNA NPW Years 6 - 15 =** | **$ 146,000.00** |
| **Plus 15% =** | **$ 1,363,000.00** |
| **Minus 10% =** | **$ 1,067,000.00** |

**EATON CORPORATION**
***IN SITU* CHEMICAL OXIDATION NET PRESENT WORTH**
**FORMER EATON SELMA FACILITY**
**1100 EAST PRESTON STREET, SELMA, JOHNSTON COUNTY, NC**

| Year | Capital Costs ($) | Annual Cost ($) | Discount Factor* | Total Cost ($) |
|---|---|---|---|---|
| 0 | $ 1,043,280.20 | $ - | 1.00000 | $ 1,043,280.20 |
| 1 | $ 334,936.19 | $ - | 0.93458 | $ 351,051.05 |
| | | $ 40,688.44 | | $ 39,547.64 |
| 2 | | $ 42,315.98 | 0.87344 | $ 36,960.41 |
| 3 | | $ 44,008.62 | 0.81630 | $ 35,924.14 |
| 4 | | $ 45,768.96 | 0.76290 | $ 34,916.92 |
| 5 | | $ 47,599.72 | 0.71299 | $ 33,937.94 |
| 6 | | $ 24,751.85 | 0.66634 | $ 16,493.21 |
| 7 | | $ 25,741.93 | 0.62275 | $ 16,030.78 |
| 8 | | $ 26,771.61 | 0.58201 | $ 15,581.32 |
| 9 | | $ 27,842.47 | 0.54393 | $ 15,144.46 |
| 10 | | $ 28,956.17 | 0.50835 | $ 14,719.85 |
| 11 | | $ 30,114.42 | 0.47509 | $ 14,307.14 |
| 12 | | $ 31,318.99 | 0.44401 | $ 13,906.01 |
| 13 | | $ 32,571.75 | 0.41496 | $ 13,516.12 |
| 14 | | $ 33,874.62 | 0.38782 | $ 13,137.16 |
| 15 | | $ 35,229.61 | 0.36245 | $ 12,768.83 |
| **Total** | **$ 1,378,216.39** | **$ 517,555.13** | | **$ 1,722,000.00** |

| | |
|---|---|
| **Total Dollars =** | **$ 1,896,000.00** |
| **Plus 15% =** | **$ 2,181,000.00** |
| **Minus 10% =** | **$ 1,707,000.00** |

| | |
|---|---|
| **2 Injections & Monitoring (Year 0) =** | **$ 1,044,000.00** |
| **Reinjection NPW (Year 1) =** | **$ 352,000.00** |
| **MNA NPW Year 0 =** | **$ 79,000.00** |
| **MNA NPW Years 1 - 5 =** | **$ 182,000.00** |
| **MNA NPW Years 6 - 15 =** | **$ 146,000.00** |

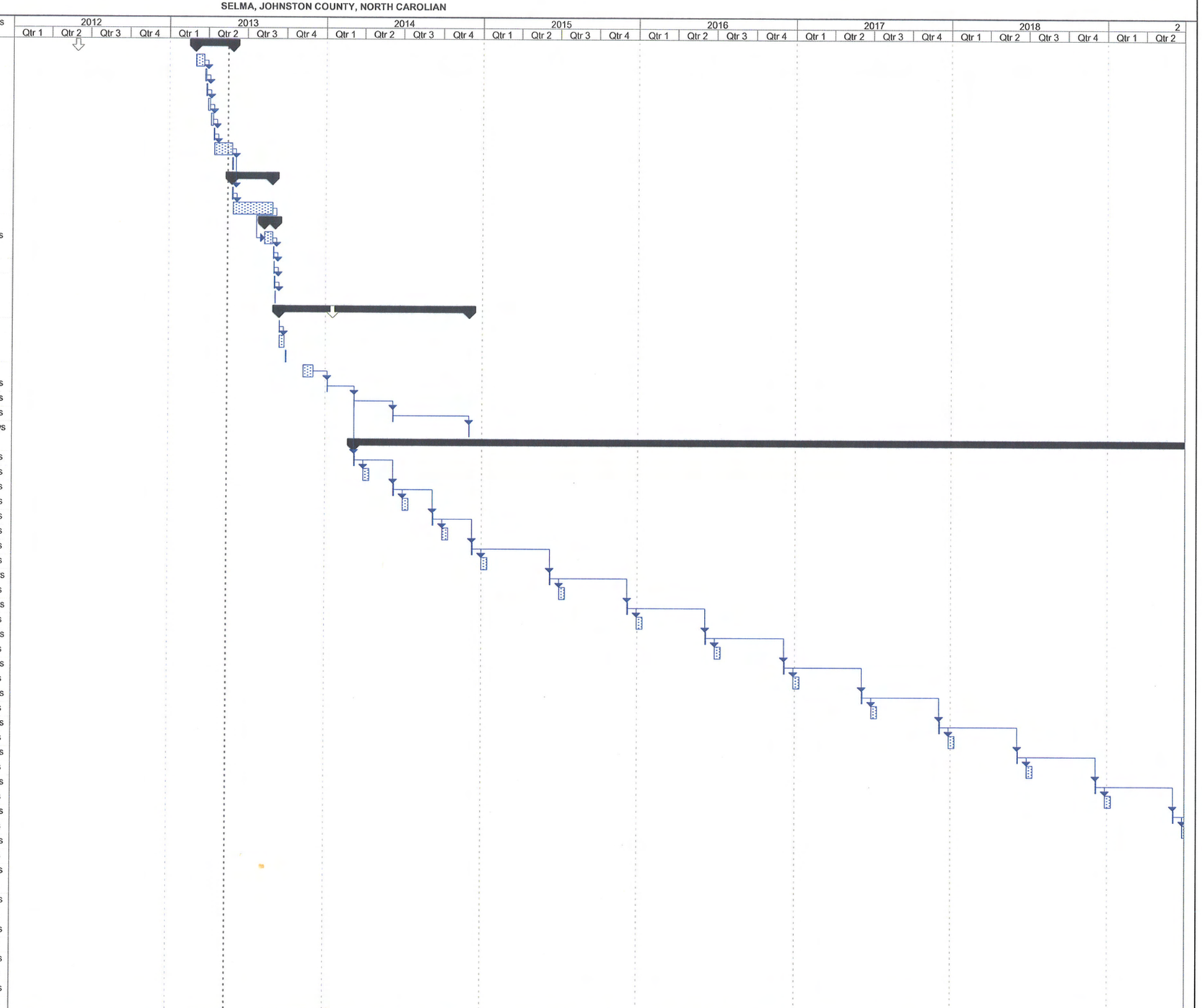
| | |
|---|---|
| **Plus 15% =** | **$ 1,981,000.00** |
| **Minus 10% =** | **$ 1,550,000.00** |

# APPENDIX B

## PROJECT SCHEDULE

**EATON SELMA**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLIAN**

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 1 | **Remedial Action Plan for Groundwater** | **63 days** | **Mon 3/4/13** | **Wed 5/29/13** | |
| 2 | Draft | 15 days | Mon 3/4/13 | Fri 3/22/13 | |
| 3 | Peer Review | 3 days | Mon 3/25/13 | Wed 3/27/13 | 2 |
| 4 | Senior Review | 2 days | Thu 3/28/13 | Fri 3/29/13 | 3 |
| 5 | AES Review | 5 days | Mon 4/1/13 | Fri 4/5/13 | 4 |
| 6 | Final | 5 days | Mon 4/8/13 | Fri 4/12/13 | 5 |
| 7 | Submit to REC Program for Public Comment | 1 day | Mon 4/15/13 | Mon 4/15/13 | 6 |
| 8 | 30 Day Public Comment Period | 30 days | Tue 4/16/13 | Mon 5/27/13 | 7 |
| 9 | Certify RAP Complete | 2 days | Tue 5/28/13 | Wed 5/29/13 | 8 |
| 10 | **UIC Permit** | **69 days** | **Tue 5/28/13** | **Fri 8/30/13** | |
| 11 | Submit UIC Permit | 2 days | Tue 5/28/13 | Wed 5/29/13 | 8 |
| 12 | UIC Permit Review Period | 67 days | Thu 5/30/13 | Fri 8/30/13 | 11 |
| 13 | **Pre-Construction Report** | **20 days** | **Mon 8/12/13** | **Fri 9/6/13** | |
| 14 | Draft | 15 days | Mon 8/12/13 | Fri 8/30/13 | 12FS-15 days |
| 15 | Peer Review | 1 day | Mon 9/2/13 | Mon 9/2/13 | 14 |
| 16 | Senior Review | 1 day | Tue 9/3/13 | Tue 9/3/13 | 15 |
| 17 | AES Review | 2 days | Wed 9/4/13 | Thu 9/5/13 | 16 |
| 18 | Final | 1 day | Fri 9/6/13 | Fri 9/6/13 | 17 |
| 19 | **Groundwater Remedial Action** | **317 days** | **Mon 9/16/13** | **Tue 12/2/14** | |
| 20 | Utility Locate | 1 day | Mon 9/16/13 | Mon 9/16/13 | |
| 21 | Install Monitoring and Injection Wells | 10 days | Mon 9/16/13 | Fri 9/27/13 | 20FS-1 day |
| 22 | Baseline Sampling Event | 2 days | Tue 10/1/13 | Wed 10/2/13 | |
| 23 | Injection | 18 days | Mon 11/11/13 | Wed 12/4/13 | |
| 24 | Post-Injection Monitoring #1 - 1 Month | 1 day | Mon 1/6/14 | Mon 1/6/14 | 23FS+22 days |
| 25 | Post-Injection Monitoring #2 - 3 Months | 1 day | Mon 3/10/14 | Mon 3/10/14 | 24FS+44 days |
| 26 | Post-Injection Monitoring #3 - 6 Months | 1 day | Mon 6/9/14 | Mon 6/9/14 | 25FS+64 days |
| 27 | Post-Injection Monitoring #4 - 12 Months | 1 day | Tue 12/2/14 | Tue 12/2/14 | 26FS+125 days |
| 28 | **MNA Monitoring** | **4131 days** | **Mon 3/10/14** | **Mon 1/7/30** | |
| 29 | Year 0 - Quarter 1 | 2 days | Mon 3/10/14 | Tue 3/11/14 | 24FS+44 days |
| 30 | Year 0 - Quarter 1 Groundwater Monitoring Report | 10 days | Tue 4/1/14 | Mon 4/14/14 | 29FS+14 days |
| 31 | Year 0 - Quarter 2 | 2 days | Tue 6/10/14 | Wed 6/11/14 | 29FS+64 days |
| 32 | Year 0 - Quarter 2 Groundwater Monitoring Report | 10 days | Wed 7/2/14 | Tue 7/15/14 | 31FS+14 days |
| 33 | Year 0 - Quarter 3 | 2 days | Wed 9/10/14 | Thu 9/11/14 | 31FS+64 days |
| 34 | Year 0 - Quarter 3 Groundwater Monitoring Report | 10 days | Thu 10/2/14 | Wed 10/15/14 | 33FS+14 days |
| 35 | Year 0 - Quarter 4 | 2 days | Wed 12/10/14 | Thu 12/11/14 | 33FS+63 days |
| 36 | Year 0 - Quarter 4 Groundwater Monitoring Report | 10 days | Thu 1/1/15 | Wed 1/14/15 | 35FS+14 days |
| 37 | Year 1 - Semiannual 1 | 2 days | Wed 6/10/15 | Thu 6/11/15 | 35FS+128 days |
| 38 | Year 1 - Semiannual 1 Groundwater Monitoring Rep | 10 days | Thu 7/2/15 | Wed 7/15/15 | 37FS+14 days |
| 39 | Year 1 - Semiannual 2 | 2 days | Wed 12/9/15 | Thu 12/10/15 | 37FS+128 days |
| 40 | Year 1 - Semiannual 2 Groundwater Monitoring Rep | 10 days | Thu 12/31/15 | Wed 1/13/16 | 39FS+14 days |
| 41 | Year 2 - Semiannual 1 | 2 days | Wed 6/8/16 | Thu 6/9/16 | 39FS+128 days |
| 42 | Year 2 - Semiannual 1 Groundwater Monitoring Rep | 10 days | Thu 6/30/16 | Wed 7/13/16 | 41FS+14 days |
| 43 | Year 2 - Semiannual 2 | 2 days | Wed 12/7/16 | Thu 12/8/16 | 41FS+128 days |
| 44 | Year 2 - Semiannual 2 Groundwater Monitoring Rep | 10 days | Thu 12/29/16 | Wed 1/11/17 | 43FS+14 days |
| 45 | Year 3 - Semiannual 1 | 2 days | Wed 6/7/17 | Thu 6/8/17 | 43FS+128 days |
| 46 | Year 3 - Semiannual 1 Groundwater Monitoring Rep | 10 days | Thu 6/29/17 | Wed 7/12/17 | 45FS+14 days |
| 47 | Year 3 - Semiannual 2 | 2 days | Wed 12/6/17 | Thu 12/7/17 | 45FS+128 days |
| 48 | Year 3 - Semiannual 2 Groundwater Monitoring Rep | 10 days | Thu 12/28/17 | Wed 1/10/18 | 47FS+14 days |
| 49 | Year 4 - Semiannual 1 | 2 days | Wed 6/6/18 | Thu 6/7/18 | 47FS+128 days |
| 50 | Year 4 - Semiannual 1 Groundwater Monitoring Rep | 10 days | Thu 6/28/18 | Wed 7/11/18 | 49FS+14 days |
| 51 | Year 4 - Semiannual 2 | 2 days | Wed 12/5/18 | Thu 12/6/18 | 49FS+128 days |
| 52 | Year 4 - Semiannual 2 Groundwater Monitoring Rep | 10 days | Thu 12/27/18 | Wed 1/9/19 | 51FS+14 days |
| 53 | Year 5 - Semiannual 1 | 2 days | Wed 6/5/19 | Thu 6/6/19 | 51FS+128 days |
| 54 | Year 5 - Semiannual 1 Groundwater Monitoring Rep | 10 days | Thu 6/27/19 | Wed 7/10/19 | 53FS+14 days |
| 55 | Year 5 - Semiannual 2 | 2 days | Wed 12/4/19 | Thu 12/5/19 | 53FS+128 days |
| 56 | Year 5 - Semiannual 2 Groundwater Monitoring Rep | 10 days | Thu 12/26/19 | Wed 1/8/20 | 55FS+14 days |
| 57 | Year 6 - Annual | 2 days | Mon 11/30/20 | Tue 12/1/20 | 55FS+256 days |
| 58 | Year 6 - Annual Groundwater Monitoring Report | 10 days | Tue 12/22/20 | Mon 1/4/21 | 57FS+14 days |
| 59 | Year 7 - Annual | 2 days | Wed 12/1/21 | Thu 12/2/21 | 57FS+260 days |
| 60 | Year 7 - Annual Groundwater Monitoring Report | 10 days | Thu 12/23/21 | Wed 1/5/22 | 59FS+14 days |
| 61 | Year 8 - Annual | 2 days | Fri 12/2/22 | Mon 12/5/22 | 59FS+260 days |
| 62 | Year 8 - Annual Groundwater Monitoring Report | 10 days | Mon 12/26/22 | Fri 1/6/23 | 61FS+14 days |
| 63 | Year 9 - Annual | 2 days | Tue 12/5/23 | Wed 12/6/23 | 61FS+260 days |
| 64 | Year 9 - Annual Groundwater Monitoring Report | 10 days | Wed 12/27/23 | Tue 1/9/24 | 63FS+14 days |
| 65 | Year 10 - Annual | 2 days | Fri 11/29/24 | Mon 12/2/24 | 63FS+256 days |
| 66 | Year 10 - Annual Groundwater Monitoring Report | 10 days | Mon 12/23/24 | Fri 1/3/25 | 65FS+14 days |

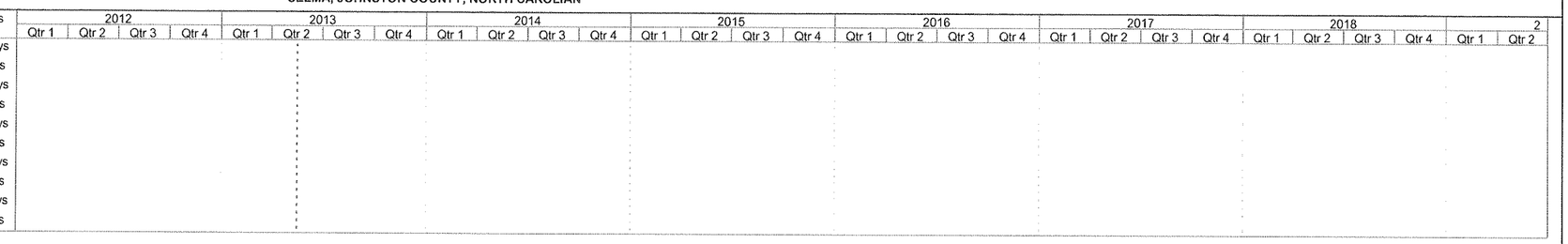



Project: Eaton Selma
Date: Thu 5/16/13

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

**EATON SELMA**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLIAN**

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 67 | Year 11 - Annual | 2 days | Tue 12/2/25 | Wed 12/3/25 | 65FS+260 days |
| 68 | Year 11 - Annual Groundwater Monitoring Report | 10 days | Wed 12/24/25 | Tue 1/6/26 | 67FS+14 days |
| 69 | Year 12 - Annual | 2 days | Thu 12/3/26 | Fri 12/4/26 | 67FS+260 days |
| 70 | Year 12 - Annual Groundwater Monitoring Report | 10 days | Fri 12/25/26 | Thu 1/7/27 | 69FS+14 days |
| 71 | Year 13 - Annual | 2 days | Thu 12/2/27 | Fri 12/3/27 | 69FS+258 days |
| 72 | Year 13 - Annual Groundwater Monitoring Report | 10 days | Fri 12/24/27 | Thu 1/6/28 | 71FS+14 days |
| 73 | Year 14 - Annual | 2 days | Thu 11/30/28 | Fri 12/1/28 | 71FS+258 days |
| 74 | Year 14 - Annual Groundwater Monitoring Report | 10 days | Fri 12/22/28 | Thu 1/4/29 | 73FS+14 days |
| 75 | Year 15 - Annual | 2 days | Mon 12/3/29 | Tue 12/4/29 | 73FS+260 days |
| 76 | Year 15 - Annual Groundwater Monitoring Report | 10 days | Tue 12/25/29 | Mon 1/7/30 | 75FS+14 days |

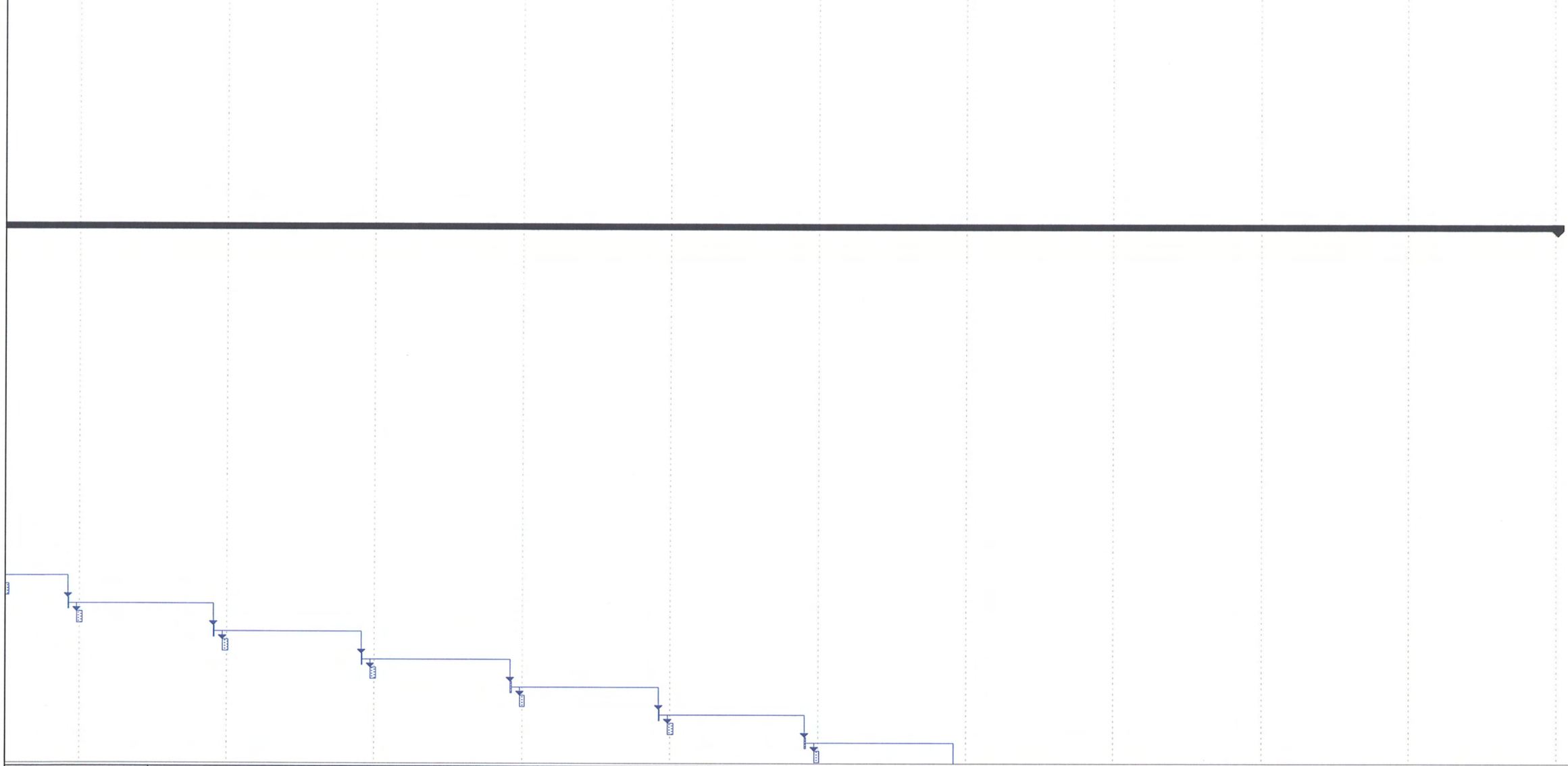



Project: Eaton Selma
Date: Thu 5/16/13

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

**EATON SELMA**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLIAN**

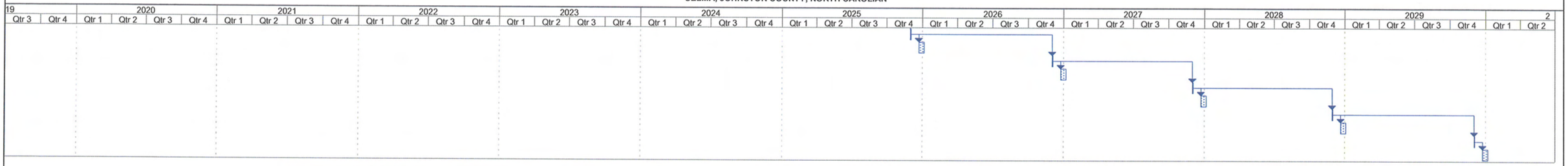
| 19 | | 2020 | | | | 2021 | | | | 2022 | | | | 2023 | | | | 2024 | | | | 2025 | | | | 2026 | | | | 2027 | | | | 2028 | | | | 2029 | | | | 2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Qtr 3 | Qtr 4 | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Qtr 1 | Qtr 2 | Qtr 3 | Qtr 4 | Qtr 1 | Qtr 2 |



Project: Eaton Selma
Date: Thu 5/16/13

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

**EATON SELMA**
**1100 EAST PRESTON STREET**
**SELMA, JOHNSTON COUNTY, NORTH CAROLIAN**




Project: Eaton Selma
Date: Thu 5/16/13

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

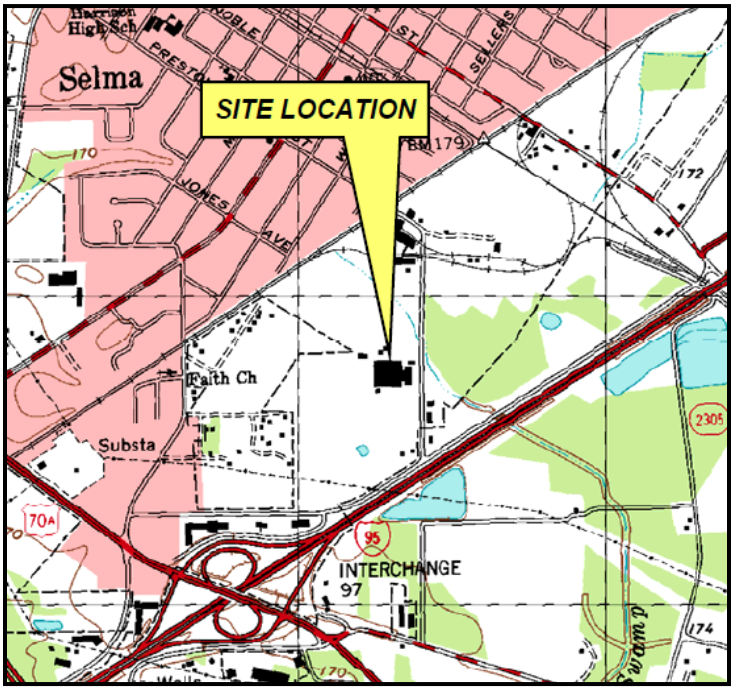
# APPENDIX C

## COMMUNITY HEALTH AND SAFETY PLAN

# COMMUNITY HEALTH AND SAFETY PLAN
# FORMER EATON CORPORATION FACILITY
# 1100 EAST PRESTON STREET
# SELMA, JOHNSTON COUNTY, NORTH CAROLINA

## A. GENERAL INFORMATION

**Site Name:** Former Eaton Corporation Facility/Selma
**Location:** 1100 East Preston Street Selma, NC




## B. PROJECT SUMMARY

Solutions-IES, Inc. (Solutions-IES) is preparing a Remedial Action Plan (RAP) for Groundwater for the former Eaton Corporation (Eaton) facility located at 1100 East Preston Street in Selma, Johnston County, North Carolina. The RAP for Groundwater is being completed in accordance with the Registered Environmental Consultant (REC) Program as administered by the Inactive Hazardous Sites Branch (IHSB), Superfund Section, Division of Waste Management (DWM), North Carolina Department of Environment and Natural Resources (NCDENR).

The purpose of the RAP is to:

- Discuss results of the remedial investigation;
- State the objectives for remedial action;
- Evaluate remedial alternatives using the seven feasibility study criteria (protection of human health and the environment, compliance with regulations, long-term effectiveness, reduction of toxicity, mobility, and volume, short-term effectiveness, implementability, cost, and community acceptance);
- Provide a detailed description and conceptual design of the proposed remedy;
- Demonstrate that the proposed remedy is supported by the remedial alternative feasibility study;
- Provide a description of all activities necessary to implement the proposed method(s) of remedial action;
- Provide a description of any proposed treatability studies and additional site characterization needed to support the final design;
- Provide a description of procedures and a schedule;
- Provide a description of the criteria for remedial action completion, including procedures for post-remedial and confirmatory sampling;
- Include a community health and safety plan; and

- Describe equipment and personnel decontamination procedures.

## C. INTRODUCTION

The remedial action for groundwater at the Former Eaton Corporation Facility in Selma, North Carolina will occur at an active facility and could potentially create hazards to the public. The purpose of this document is to describe the potential hazards and control measures to be used by Solutions-IES during the remedial action implementation.

Physical hazards associated with the use of heavy equipment and vehicles, in many respects similar to those used for small construction projects, are the potential hazards of concern for the remedial action implementation. Workers and subcontractors employed by Solutions-IES will also be working under a site-specific Health and Safety Plan and will also be responsible for implementing this Community Health and Safety Plan.

The primary community health and safety concerns for this site are associated with injection well and monitoring well installation and sampling equipment, injection equipment, vehicles, possible odors that may be generated during the remedial action implementation and other hazards associated with subsurface field remediation.

## D. BACKGROUND

The site consists of 20 acres of developed and wooded land with a 90,000 square foot manufacturing building and three smaller storage buildings located north of the manufacturing building. The site is currently owned by Johnston County Industries (JCI), a community rehabilitation facility to evaluate, train, and return individuals with vocational barriers to employment.

The property was agricultural land prior to 1958. Eaton acquired the property in 1976 when the facility was used to manufacture and assemble winding resistors, small parts, and switches. Various industrial processes were employed at the plant, including injection molding (thermoset and thermoplastic), metal stamping and parts cleaning and washing. The facility also stored and used a variety of oils, hydraulic fluids and solvents in their processes.

## E. CHEMICALS OF CONCERN

Tetrachloroethene ( PCE), trichloroethene (TCE), and 1,1-dichloroethene (1,1-DCE) are the contaminants of concern (COCs) in groundwater at the former Eaton Selma facility, with PCE being the primary COC.

## F. EVALUATION OF POTENTIAL PUBLIC EXPOSURE TO HAZARDS

A summary of the potential hazards, routes of exposure, and potential targets is presented in the table below. The duration of the hazard is also evaluated and the proposed methods to prevent exposure are also given.

| Potential Hazard | Duration of Hazard | Route of Exposure | Potential Target | Control Measures used to Prevent Exposure |
|---|---|---|---|---|
| Movement and use of field vehicles, drill rigs, or vehicular traffic | Immediate | • Movement of heavy equipment or vehicles<br>• Collision with pedestrians or cars | • Pedestrians and vehicles traveling within parking lots and/or along nearby streets<br>• Ground personnel involved with the remediation | • Use of exclusion zones around the work areas<br>• Ground personnel will wear safety vests (or equivalent)<br>• Traffic control measure implemented as necessary |
| Volatile Organic Compounds in air | Short term | • Migration through the air when the soil is displace during well installation or well is opened | • Personnel involved in the investigation<br>• Those in the immediate vicinity of the work area | • Use of the exclusion zone<br>• Monitoring for volatile vapor downwind of the activities<br>• Stopping work if action levels are exceeded |
| Volatile Organic Compounds in soil and/or groundwater | Immediate | • Dermal contact with subsurface soil and water during invasive drilling and sampling | • Ground personnel and equipment operators involved in the remediation | • Use of the exclusion zone<br>• Restriction of access to trained personnel only<br>• Securing the borehole/ excavation overnight<br>• Use of signs, delineators, temporary fencing, and caution tape |

## G. CONTROL METHODS

The following control methods will be utilized during groundwater remediation to protect the public from exposure to hazardous substances.

**Site Security**
The exclusion zone is an area where public access is restricted. An exclusion zone will be set up and maintained around the work area during working hours. The exclusion zone will be marked with delineators and caution tape, as needed. Only authorized personnel will be allowed into the exclusion zone during work hours.

**Traffic and Vehicle Control**
Unrestricted personnel are not permitted to be within 20 feet of operation equipment. Safety cones will be placed at this distance from operation equipment.

**Vapors**
If, during the exclusion zone perimeter walk, a measured vapor reading of 5% of the PEL of the contaminant of concern is detected, then activities will stop, and the point source(s) of the vapor will be identified. Measures to reduce vapor emission will be taken, if necessary. PEL concentrations for contaminants of concern will be provided in the site-specific health and safety plan prepared before implementation.

**Dust**
Dust emissions may occur during drilling activities. If on visual assessment dust levels are considered to be elevated, then measures will be taken to reduce dust emissions, including misting the work area to reduce dust levels entering the breathing zone. Measures will be taken to attempt to prevent any water runoff into the street or nearby ditches.

**Noise**
Site activities will be restricted to between the hours of 7 am and 7 pm Monday through Friday. Noise levels are not anticipated to be excessive and no noise control measures are proposed for these activities.

**Emergency Planning**
In the event of an emergency situation, work at the site will be stopped until the situation is brought under control. The exclusion zone will be maintained, with only authorized site workers and emergency services personnel being allowed into the zone.

A fire extinguisher will be available on site at all times. With the exception of a small fire that would be interpreted to be safely extinguished with the use of fire extinguisher, no attempt will be made to fight a fire; however, any potentially flammable materials will be moved from the path of the fire, where judged safe.

**Contact**
If you have any questions related to the former Eaton Corporation Selma facility remediation, please call Jody Overmyer at (919) 873-1060 or email jovermyer@solutions-ies.com.